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REVIEW OF MIOCENE ANTHROPOIDEA FROM INDIA AND ADJACENT COUNTRIES

K. N. PRASAD

GEOLOGICAL SURVEY OF INDIA

ABSTRACT

The taxonomy of the Hominoidea relating to certain groups is briefly discussed and new interpretations presented. Detailed palaeonotological analysis of the hominoids of the Siwaliks indicate the occurrence of forms belonging to the Pongidae as well as the Hominidae. Of these, *Sivapithecus* (Pongidae) with three contained species and *Ramapithecus* (Hominidae) with two distinct species can be recognised. Precise understanding the range of intra-specific variations and anatomy is suggested for evaluating extinct populations. The need for critical study of variable characters in associated fauna is stressed. Biometric analysis based on modern systematics may offer guidelines for assessment of intra-specific variations and differences in morphology in evolving species of a single lineage.

Many recent discoveries of fossil hominoids principally from Spain, East Africa and India have considerably added to our understanding of the problem of initial differentiation of hominoids during Cenozoic times. It is suggested that the origin of both Pongidae and Hominidae could be traced to some species belonging to the subfamily Dryopthecinae of the Miocene. During the last decade, significant discoveries of these interesting hominoid material has given scope for elucidation of various factors concerning human origins and Primate evolution. The general intent of this brief review is to bring together the relevant known materials especially from India and adjacent countries and evaluate their systematic position. In the process of this survey, certain important originals housed in the museums in America and England were studied by the author. Evaluation of Miocene hominids indicate *Ramapithecus* is the earliest hominid known with an estimated date of about 12 million years. Facial and dental features characteristic of Pleistocene hominids had already been established by late Miocene or early Pliocene. Progressive trends in the dentition combined with Palaeobotanical evidence indicate that grinding and chewing, a specialised mode of function had been initiated at this stage. Lingual aspect of the jaw which is relatively thin and hollow probably accommodated a mobile tongue which in turn could give expression to utterance of various modes of sounds, a precursor of the orderly development of speech in later hominids. The receding maxilla and mandible gave way to crowding up dentition, elimination of diastema and late eruption of third molar. Variation as in the case of *Australopithecus* is possible in *Ramapithecus*.

Abbreviations :

A.M.N.H.	American Museum of Natural History, New York.
B.M.N.H.	British Museum (Natural History), London.
C.M.H.	Coryndon Museum of Natural History, Nairobi.
G.S.I.	Geological Survey of India, Calcutta.
O.N.G.C.	Oil and Natural Gas Commission, Dehra Dun.
U.M.	Uganda Museum, Kampala, Uganda.
Y.P.M.	Yale Peabody Museum, New Haven, Conn.

GEOLOGICAL SETTING

A three-fold division for the Siwaliks was proposed by Pilgrim (1934, 1940) mainly on the basis of the fauna since the classification based on lithology alone was found unreliable. Geological unconformities within the System except between Kamlial and Chinji do not exist. Due to tectonogenic movements, the Upper Siwaliks were laid down on the Middle Siwaliks after a period of folding, uplift and denudation. Studies have shown that the Boulder Conglomerates contain relics of Prehistoric Man, whose appearance in India, roughly coincided with the disappearance of the rich Siwalik fauna, during the refrigeration of climate.

SIWALIK SUCCESSION

	Boulder Conglomerate : Sands, gravels and conglomerates... Cromerian.
Upper Siwalik :	Pinjor Stage : Sandstones, clays and grits...Villafranchian.
(1880—2400 m)	Tatrot Stage : Soft sandstones, clays and conglomerates...Astian.
Middle Siwaliks :	Dhokpathan Stage : Brown sandstones,
(1800—2100 m)	orange clays and shales...Pontian.
	Nagri Stage : Hard grey sandstones and shales...Sarmatian.
Lower Siwaliks :	Chinji Stage : Bright red shales and
(1500 m)	sandstones...Up. Tortonian.
	Kamlial Stage : Red sandstones and purple shales...L. Tortonian.

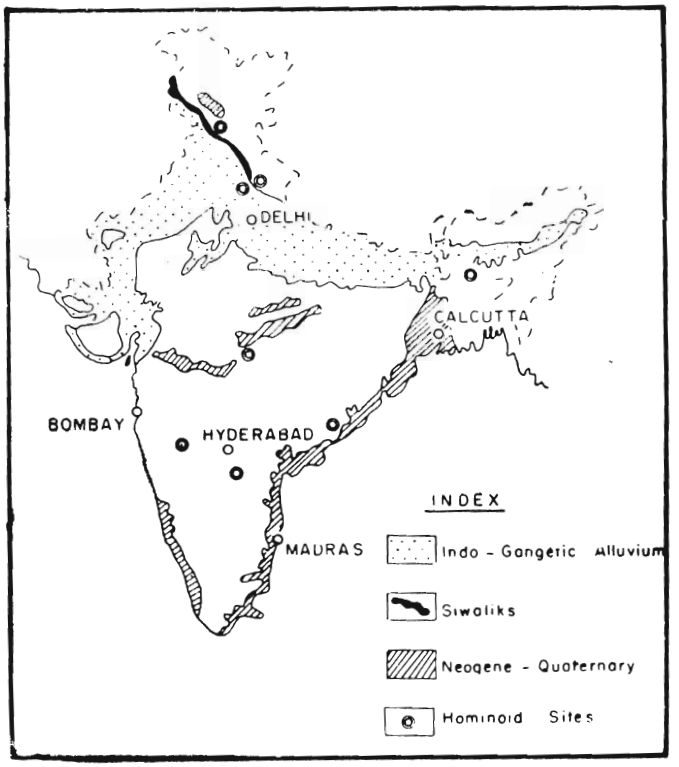
The climax of development of anthropoids in India appears to have been reached during the Chinji-Nagri period of the Siwalik System, an interval of time marked by Sarmatian-Pontian as its two furthest limits. Early Tertiary hominoid fauna has not been recorded though other groups are known from the Indian sub-continent. The reasons for the absence of early Tertiary hominoids in the Siwaliks and adjoining areas have been discussed by Wadia and Aiyengar (1938). Koenigswald (1965) concluded after study of the original material that *Pondaungia* is a Condylarth and *Amphipithecus* a Lemuroid form. Simons (1965, 1967) restudied the originals and suggested "the conclusion which must be drawn is that known materials of *Pondaungia* and *Amphipithecus* indicate, but not proof, that early hominoids or hominoid-like Primates existed in the Asian tropics before the end of the Eocene Epoch." Further, Simons (1966) pointed out "because of their fragmentary nature, the types and only specimens of *Amphipithecus* and *Pondaungia* are difficult to classify but the preserved parts are more like primates than like members of any other order. If not Anthropoidea it is just possible that they may be advanced omomyid prosimians".

(*a*) Distribution : Fossil hominoids are known from three important sites viz., (1) the much dissected sedimentary belt of the Lower and Middle Siwaliks of the Potwar Synclinal basin, (2) the area around Ramnagar, J. & K. and (3) the Haritalyangar area of Bilaspur district, Himachal Pradesh. A few other localities viz., the Narmada Alluvium, the Karnul Caves and Gokak beds where human implements have been recorded await detailed exploration. The age of these formations range from Lower to Middle Pleistocene.

(*b*) Correlation of Chinji-Nagri : The bulk of the anthropoid material is known from Chinji-Nagri beds and the author (1964, 1968) discussed this fauna in detail. Simons (1968) expressed doubts on the age of the sediments containing the hominoids. Though the clastic sediments have not been radiometrically dated, however, the faunal assemblage in general reveals a Miocene age. The Nagri fauna in general are relatively less in proportion to the Chinjis and contain a large percentage of hominoid material. Matthew (1929) and Colbert (1935) proposed that the Lower Siwalik fauna are of Pontian age. Recent work of Simons and Pilbeam (1965) and the author (1971a) has revealed that the Vallesian fauna of N. E. Spain compares favourably with those of Chinji-Nagri. Clark and Leakey (1951) and Leakey (1962) recorded a number of dryopithecine remains from East Africa. They indicate a Miocene age and may be equated with the Chinji-Nagri formations of India.

NEOGENE-QUATERNARY FORMATIONS

SHOWING HOMINOID SITES



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REVIEW OF HOMINOID MATERIAL

DRYOPITHECINES FROM INDIA

The fossil anthropoids from the Siwaliks were investigated by Lydekker during the years 1879 and 1885. Owing to their doubtful provenance, most of the finds are of limited stratigraphic significance and even the partial palate of *Palaeopithecus sivalensis* (G.S.I. D-1)

is described from an unknown horizon. Pilgrim (1915) without much justification assigned the palate to Dhokpathan (Pontian). The detached maxilla with complete dentition is one of the important finds known from the Siwaliks. Hooizer (1951) assigned part of the material (molars) to *Sivapithecus indicus* and the premolar to Pongo(?). The other highly debated tooth (*palaeosimia rugosidens*) is an upper right third molar from Chinjis having affinities with Pongo. Lewis (1937) referred this molar to *S. sivalensis*. Pilgrim (1927) during the mid-twenties, proposed many new taxa. A left ramus (G.S.I. D-197) from the Nagris was assigned to a new species *Sivapithecus himalayensis*. Later, synonimised to *S. indicus* by Lewis. A maxilla of *S. indicus* (*S. orientalis*) containing the canine, premolar-molar series with the alveolus of the central incisor and the root of the lateral incisor is considered as one of the best upper dentition recovered from the Nagri beds of Haritalyangar. The relative proportion of the dental arcade can be estimated since most of the maxilla is preserved.

The other fossil find of importance is a mandible from Chinjis of Ramnagar. The jaw (G.S.I. D-198) with M2-M3 was assigned to new species *S. middlemissi* by Pilgrim. Lewis referred the mandible to *S. indicus* and Simons and Pilbeam (1965) to *D. indicus*. The molars though partly worn, present a well developed cingulum at the base, a feature rare in the Indian Dryopithecines. *Palaeopithecus sylvaticus*, proposed by Pilgrim consists of a large ramus with P4-M3 (G.S.I. D-199). This is considered synonymous with *S. sivalensis*. Further accessions enabled Pilgrim to constitute a new genus and species *Hylopithecus hysudricus*. The fragmentary mandible consists of a partially preserved M3 highly worn and very unlikely to be a dryopithecine. Its relationship to *Pliopithecus* is also uncertain.

Barnum Brown of the American Museum of Natural History (A.M.N.H.) in the early twenties made a rich collection of fossil mammals including three anthropoid dentition. Brown, Gregory and Hellman (1924) who examined the fossils in considerable detail, proposed three new species. Of these *D. pilgrimi* and *D. cautleyi* are synonymous with *S. sivalensis*. *D. frickae* on the other-hand was included under *S. indicus*.

Further exploration of the ossiferous deposits in the Siwaliks by Pilgrim (1927) resulted in the acquisition of additional material and he proposed two new species *S. indicus* and *D. punjabicus*. The other new taxa proposed by Pilgrim (1915) were *D. giganteus*, *D. chinjiensis* and *Palaeosimia rugosidens*. The holotypes of *R. punjabicus* (non Dryopithecus) are two fragmentary mandibles (G.S.I. D-118, G.S.I. D-119) right with M3, and the left with M2 come from the Upper Chinji, The mandibles under description were allocated to a new genus *Bramapithecus*[1] by Lewis. Simons (1964) stressed their affinity with *Ramapithecus punjabicus*. Another interesting maxilla (G.S.I. D-185) assigned by Pilgrim to *D. punjabicus* is also a non *Dryopithecine*. It was assigned to *R. punjabicus* by Simons and Pilbeam (1965). Pilgrim's *D. chinjiensis* (G.S.I. D-179, 180 and 181) is considered by the author (1968) as a pygmy sized Pongid *S. chinjiensis* (Pilg.). The occurrence of this pygmy sized species in the Siwaliks has not been so far recorded.

The Yale Expedition of 1932, under the supervision of Lewis, acquired new material and these formed part of a series of research notes by Lewis (1934). One of the Important taxa proposed by Lewis with hominid affinities was *Ramapithecus brevirostris*. The holotype (Y.P.M. 13799) is from the Nagri beds. An upper canine ascribed to Simia (*Pongo*) by Lydekker (1886) obviously belongs to *S. indicus*.

The Yale-Cambridge Expedition of 1935 under the guidance of H. De Terra and assisted by Aiyengar of the Geological Survey of India, recovered fossil anthropoids from various localities in the Siwalik range. The material so accrued was subsequently published by Grogory, Hellman and Lewis (1938). A left ramus (Y.P.M. 13811) with most of the cheek teeth preserved was assigned to a new genus (*Sugrivapithecus*)[2] by Lewis (1934). The holotype is from the Nagri Stage of the Middle Siwaliks. A right mandible (Y.P.M. 13825) assigned to *S. gregoryi* is considered synonymous with *Sivapithecus sivalensis* by Simons and Pilbeam (1965). In a latter paper Lewis (1937) reviewed some of the earlier material but could not define the status of *Sugrivapithecus* and *Bramapithecus*. Though *Bramapithecus* has been reasonably assigned to *Ramapithecus* by Simons, the status of *Sugrivapithecus* is still uncertain. Some of the finds may possibly be assigned to *S. sivalensis*.

Dryopithecus giganteus is one of the largest dryopithecine molars (G.S.I. D-175) from the Nagri beds of Alipur. The crown which is the only portion preserved, is the largest third molar so far described from the Siwaliks. It can be reasonably assigned with *S. indicus*. Simons and Pilbeam (1965) suggest "it is within the size range of M 3's of *Gorilla gorilla* and of *Gigantopithecus blacki*". Koenigswald (1949) proposed a new genus *Indopithecus* for the reception of this molar. The maxilla which has evoked much discussion in recent years is that of *Ramapithecus* described by Lewis. The holotype (Y.P.M. 13799) in the collection of the Yale Peabody Museum was critically examined by the writer (1968). For a number of years, the provenance of this maxilla (see Simons and Pilbeam (1965) was in dispute being assigned to a much younger formation (Tatrots) on misleading

[1] Hindu God, Creator, 1st of the trinity.

[2] King of Man-like apes in Hindu epic Ramayana.

information supplied by the native collectors. The age of this species was considerably reduced and new interpretations were posited. Prasad's intensive work in the Siwaliks extending over a number of years and subsequent clarification by Lewis and Krynine (based on the matrix) has finally resolved that the species is no younger than the Miocene. The fragment of right maxilla *R. hariensis* (Y.P.M. 13807) and M.C.Z. 8386) is assigned to *sivalensis*.

The author (1954, 1962, 1964, 1970, 1971, 1973, 1974, 1975) carried out intensive research on anthropoid material recovered from Haritalyangar area Himachal Pradesh. One of the interesting finds is a large mandible (G. S. I. 18039) with crowns of P 3-M 3, alveolus of canine and part of symphysis. Extreme wear in the holotype indicates an aged individual. X-ray photographs revealed the absence of a diasteama between the third premolar and the canine. The left canine has also been lost and the alveolus is filled with cancellous bone. The writer assigned the mandible to a new species *S. aiyengari* on morphologic and metric grounds. Lately Simons and Pilbeam (1965) have advocated its retention under *Dryopithecus indicus* (Pilg.). The jaw proportions and molar pattern recall that of *Proconsul major* from East Africa. In addition to this mandible, three other finds have also been recorded by Prasad (1962). Two isolated first molars (G.S.I. 18041, 18042) have been assigned to *S. sivalensis*. The other component is a fragment of mandible (G.S.I. 18040) with second and third molars is referred to *S. indicus*. The only upper third molar of *Ramapithecus punjabicus* (G.S.I. 18068) recovered by the author is from the same Nagri horizon. In addition to the holotype of *Ramapithecus brevirostris* (Y.P.M. 13799), another maxilla (G.S.I. 18064) has also been collected from these Miocene beds.

A mandible with P 3 through M 3 from the Nagri Stage, near Bandel, Himachal Pradesh, collected by the O.N.G.C., is one of the latest anthropoid material to come to light. These are assigned to *Sivapithecus* by the writer. Three more finds by the O.N.G.C. needs study. Chopra and his associates from the Anthropology Department, Chandigarh have carried out intensive exploration of fossiliferous sites in Siwaliks. Chopra (1974, 1975) in suggestive papers reviewed and described new material including the firstr ecord of *Gigantopithecus*.

REMARKS ON DRYOPITHECINES FROM INDIA

The Siwalik deposits contain both the short jawed as well as the elongated varieties of Dryopithecines. Complete jaws, where the lower border is preserved, indicate that three species of *Sivapithecus* can be sustained. The relatively short jawed forms with typical dryopithecine pattern of molars are assignable to *Sivapithecus sivalensis*. The robust, relatively elongated forms with traces of cingulum in the second and third molars belong to *Sivapithecus indicus*. The third variety with massive robust, deep mandible with high mandibular and symphysial slopes at P3 and M3 respectively belong to *S. aiyengari*. However, for lack of additional material, *S. aiyengari* is provisionally retained under *S. indicus*. The fourth variety includes pygmy sized forms with smaller, delicate jaws with narrow cheek teeth and are assignable to Sivapithecus chinjiensis. Pilbeam (1966) pointed out "probably part of (*Proconsul*) is ancestral to Chimpanzee and part to Gorilla, while part of *Sivapithecus* is ancestral to Orang-utan."

Many of the new species of *Dryopithecus* referred by Pilgrim (1927) from the Sivaliks, have mostly been invalidated and some of them have been included under new taxa. Pathological deformation of known parts of dentition, differential weathering and lack of associated upper and lower dentitions in many cases, have made the correlation difficult. Lack of precise data on the various new finds, and inability to examine the actual specimens (by Vertebrate Palaeontologists in general and Palaeoanthropologists in particular) are some of the reasons that have contributed for lack of understanding of Primate taxonomy. There seems to be no agreed concensus regarding the status of various finds of dryopithecines. Gregory, Hellman and Lewis (1938) clarified the taxonomy of the dryopithecines and lucidly discusesd the character differences between *Sivapithecus* and *Dryopithecus*. Clark and Leakey (1951) justified the specific separation of *S. africanus* from the Indian species because of "certain features such as the flatness of the palate, which Pilgrim notes is high and arched in *S. orientalis*, the persistence of a trace of the antero-internal cingulum on the upper molars (which, however is also indicated in an upper molar D-176, of *S. indicus*) the development of the internal cingulum on P4, and the slightly smaller width of the upper molars. Moreover, it is extremely improbable that representatives of an identical species would be found so widely separated in space and time". It is interesting to recall that none of the upper molars of the Indian dryopithecines show pronounced cingulum, though they are faint in lower dentition.

MORPHOLOGIC CHARACTERS AND RANGE OF VARIABILITY

It is sometimes misleading to evaluate the fossils on the strength of range of variability based on living species, when we are not fully conversant of the range of characteristics present in extinct populations. The limited knowledge of the whole anatomy of extinct organisms should preclude taxonomists in formulating principles based on living species. To mitigate this difficulty, the range of variation in other associated fauna should be critically evaluated for study of fossil hominoids. A

preliminary appraisal on the range of variability in a selected group of mammals particularly from the Siwaliks of India has thrown some new light. The critical study of the range of variation in contemporary fauna, such as *Synconolophus ptychodus* distributed in the Chinji-Nagri has demonstrated significant pattern in molar evolution. Osborn (1936) traced three ascending mutations within a thickness of 600 metres from the base. *S. ptychodus*, a primitive form, differs from *S. dhokpathanensis*, a highly specialised elephant of the Pontian, in known parts of dentition. *Gazella*, a relatively primitive species does not show sufficient range of variability from Chinji (Up. Tortonian) to Dhokpathan (Pontian), except in acquiring a Caprine type of upper molar with short nasals. Among other forms such as bovids, we see a gradual thickening of horn cores from the primitive *Strepsiportax* to *Pachyportax*. From *Tragocerus punjabicus* to *T. perimensis*, the range of variability is in the skull and horn core patterns (Pilgrim 1939). Among the suids, the range of variability in the morphologic and metric characters of the premolar-molar series is considerable as demonstrated from the study of such primitive species as *Palaeochoerus* and much complex groups as *Dicoryphochoerus-Hippohyus*.

Statistical studies on the range of variability in other contemporary fauna have also provided interesting results. The Carnivores offer a good example for study of evolutionary patterns of canines and carnasials. A gradual evolution of the hypoconid and cingulum in relation to the carnasials in *Amphicyon palaeindicus* is only one example of range of variability expressed in these canids. Similar studies on hyaenids such as *Ictitherium* and *Crocuta* have thrown additional light on the range of variability. Variation in the size of protocone in equids, *Hipparion antelopinum* and other species of *H. theobaldi* on the basis of scatter diagrams, indicate the possibility of sustaining only two species in the Siwaliks. Similar approach is also possible for analysing patterns of variation in other groups of mammals. Such critical observations indicate that differences in character may not be fully accommodated within the range of variability for distinguishing two or more species of a given genus. The relation of population to environment also needs elaborate study; (Schultz, 1963).

STATUS OF DRYOPITHECINES

Simons and Pilbeam (1965) gave subgeneric status to *Proconsul* and *Sivapithecus* and assigned them to the genus *Dryopithecus*. Often doubts have been expressed on the validity of comparing species with those described by Pilgrim as *Dryopithecus*. However, recent evaluation has shown that many of the dryopithecines and hominids could not be clarified for want of complete material. Some of the finds assigned to *Dryopithecus* by Pilgrim, appears to need generic separation. Vertebrate Palaeontologists normally do not ignore the range of variation present among various species of the living and extinct populations. As pertinently pointed out by Clark (1955) "Vertebrate taxonomists are, of course, well accustomed to taking account of groups of characters in their assessment of the zoological status of an animal, and they are quite conversant with the phrase "character complex". But anthropologists and human anatomists (perhaps from lack of experience in the practice and principles of taxonomy) often tend to focus their attention rather on single characters in their discussion of relationships".

A. Sivapithecus[1]

This genus has been analysed in considerable detail and ideas regarding their temporal position, geographic distribution and status has varied according to individual investigator. The genus evoked much discussion and criticism when Pilgrim (1915) included its possible relationships with hominids. Generic separation was also questioned by many and Simons and Pilbeam preferred to include *Sivapithecus* as a subgenus of *Dryopithecus*, a genus prevalent in the Mio-Pliocene deposits of Europe. Recently, the writer has examined the entire *Sivapithecus* material in considerable detail. The study was based on (1) Biometrics, (2) X-Ray study with reference to root pattern and presence or absence of diastema and (3) Faunal associations and (4) Ecology. Sustained studies taking groups of characters in the study of dentition, mandibular slope, depth, symphysial angle, differences in indices, statistical parameters, development of internal and external cingula and simian shelf indicate that they may have formed the source material from which the great apes may have ultimately evolved. Gregory, Hellman and Lewis (1938) constructed an index by expressing M 1 length— M 2 length, as a percentage of depth of mandible for distinguishing *D. fontani* from *S. Sivalensis*. *D. fontani* values for this index range between 58 and 69 and *S. Sivalensis* (Y.P.M. 13811) gives a value of 92.5 (est.) according to Gregory, Hellman and Lewis. Simons and Pilbeam (1965) pointed out "this index may constitute a valid distinction since the European and Indian values appear to cluster at extreme ends of the scale. However, the material represents a very limited sample, and a small random sample of Pan (4 specimens) range between 69 and 94". To suggest that most of the size ratios fall within the ambit of variable characters and that there is no significant difference in tooth pattern or structure in hypodigm material of *Dryopithecus* and *Sivapithecus* may be to urge conservatism in taxonomic usage. In the present state of our knowledge, three species of *Sivapithecus* (*S. indicus*, *S. sivalensis* and *S. chinjiensis*) could be defined. Of these, *Sivapithecus sivalensis* was a medium sized species with upper molars crowns showing

[1]Named after Shiva, one of the Hindu God trinity.

sharp crenulations with reduced cingulum. Cusps are less bunodont. Simons and Pilbeam (1965) refer this species as comparable in most dimensions to *D. nyaanzae* and *D. fontani*. However, it should be pointed out that none of the *Sivapithecus* material from the Siwaliks possess a beaded cingulum in the upper molars as in the case with "*D. nyanzae*". Clark and Leakey justify the specific separation of *Sivapithecus africanus* and *S. sivalensis* on the flatness of the palate and the presence of trace of antero-internal cingulum. Simons and Pilbeam (1965) pointed out "All the character differences cited in this diagnosis can be accommodated within the range of variability of extant hominoid species and are insufficient for distinguishing *S. africanus* from Indian *Sivapithecus*." The Rusinga deposits are now considered younger than Siwalik deposits. Except for some minor differences in the molar pattern and size ratios, *S. africanus* apparently does not differ from the Indian species and therefore, the writer follows Simons and Pilbeam in retaining the African material under *S. sivalensis* (Lyd.). This is referred to *D. sivalensis* by Simons and Pilbeam, as per their generic terminology.

MEAN MANDIBULAR MEASUREMENTS IN MILLIMETRE
(After Simons and Pilbeam, 1965)

	D. fontani	*D. sivalensis*	*D. nyanzae*
M 1 Mesio-distal diam ..	10.1	10.8	9.3
M 1 Trigonid diam	8.8	9.5	8.2
M 1 Talonid diam	9.0	9.5	—
M 2 Mesio-distal diam ..	11.1	12.1	11.8
M 2 Trigonid diam	10.3	11.0	10.2
M 2 Talonid diam	10.3	10.7	..

Analysis : Previously, there was some confusion regarding the allocation of certain *Sivapithecus* mandibles from India. Pilgrim (1915) assigned one of the incomplete mandibles (G.S.I. D-177) from Chinji to *Sivapithecus indicus*. Its affinities to *S. sivalensis* was stressed by Lewis (1937). Simons and Pilbeam (1965) referred the mandible to (*D. indicus*). However, recent studies by the author indicate that the mandible under reference may be assigned to *S. sivalensis*. Some of the isolated, narrow molars previously assigned to *Sugrivapithecus* are actually the lower molars of *S. sivalensis*. Simons and Pilbeam (1965) arrived at the interesting conclusion "the low coefficients of variation in this sample are interesting in view of the probable long temporal and wide geographic ranges involved. Differences do exist between *D. nyanzae*, and the *D. fontani*/*D. sivalensis* group and the three species are sustained here because of geographic separation and apparent differences in geologic age, symphysial structure, and robusticity and height of mandibular ramus."

The first and second molars of *Sivapithecus* are known to be larger than the *Dryopithecus* of Europe, though this feature may come under the range of variability. The mandible in *Sivapithecus* is apparently shallow when compared to *Dryopithecus*. Attention was focussed by Gregory, Hellman and Lewis (1938) "the comparative measurements also show that the depth of the mandible between M 1 and M 2 is relatively greater in the European than in the Siwalik members of the "*Dryopithecus* group". Some of the mandibles studied also demonstrate diffreences in the degree of thickness as for example in *Dryopithecus*, it is robust but in *Sivapithecus chinjiensis*, it is delicate and thin. Apparently, it is difficult to explain these conditions as we are dealing with highly variable jaws and dentition of species, distributed from Spain to China. The angle of slope of the symphysis in addition to the height, sometimes give clue for specific distinction. The second species which represents a small sized pongid, smaller than *S. sivalensis* and *S. indicus* was apparently confused for a hominid and designated *Ramapithecus* cf. *brevirostris* by Lewis (1938). On the possible occlusal relationships, it was referred to *Ramapithecus* by Gregory, Hellman and Lewis. They further stated "the teeth are somewhat too narrow and the P 3 has its long axis too antero-posteriorly oriented to fulfil completely the requirements of a lower dentition of the genotype". Simons (1961, 1964) pointed out the dissimilarities of this form with *Ramapithecus* on the basis of a sectorial third premolar, the U-shaped dental arcade and the presence of a simian shelf. While comparing the two mandibles (B.M.N.H.-15243 and G.S.I. D-618), Simons pointed out "these two specimens appear to represent in decreasing order of probability, (*a*) new species, (*b*) a pygmy race of one of described Eurasian Pongids, or (*c*) an Indian variety of *Proconsul africanus*". Lately Simons and Pilbeam (1965) refer this form to *Dryopithecus laietanus* (Villalta and Crusafont), the holotype coming from Northern Spain. In the first instance it is not a hominid, and secondly, it is a small sized pongid of the Siwaliks and designated *Sivapithecus chinjiensis* (Pilg.) For some unknown reasons, the existence of this species has not been recognised by previous workers and new taxa have been proposed without any valid reason (Prasad, 1971a). This pygmy race has a bearing on the evolution of anthropoids and more especially on the living great apes in particular.

The well known fossil ape from the Siwaliks, *Sivapithecus indicus*, is one of the largest dryopithecine known. Simons and Pilbeam (1965) suggested that "*D. indicus*" species is wide-ranging in Eurasia but is not known from Western Europe. They also pointed out "*Indopithecus*" and "*Ankarapithecus*" assigned here to *D. indicus* are larger and may have existed somewhat later in time than other members of this species, which is to be expected in time

successive populations (Copesrule)". However, *Indopithecus* (*S. indicus*) is from the Nagri horizon found north of Alipur, and is doubtful whether it evolved later in Pliocene. There is a possibility of similar or closely allied species occurring in East Africa, but whether they were wide ranging in Eurasia remains to be investigated.

HOMINOID MATERIAL FROM AFRICA

The first dryopithecine recovered from Africa dates back to 1918, when a new taxa *D. mogharensis* was proposed. The Wadi Moghara material from Egypt was considered Miocene in age. Simons (1966) re-examined the *D* (*?*) *mogharensis* and assigned the material to a Cercopithecoid monkey. The other fossil pongid described was by Lonnberg (1937). Simons (*Op. cit.*) expressed doubts on its relationship to a dryopithecine. Recent collections from Kavirondo Gulf area, Kenya, Napak and Moroto, Uganda (U. M.) and Omo basin has thrown more light on the distribution of these forms. Monographic work by Hopwood (1933), Clark and Leakey (1950, 1951) Allbrook and Bishop (1963) and Clark (1968) has added to our understanding of the early hominoids. The recent collections from Kenya and Uganda have been dealt with in considerable detail by Leakey (1962, 1963, 1965), Simons and Pilbeam (1965) and Simons (1964, 1968). The faunal elements in the Rusinga, Fort Ternan sites indicate a Miocene age. Potassium Argon dating of the Fort Ternan deposits indicate an age of 14 millions years. Precise dating of the Siwalik deposits is difficult though it is estimated at 15 million years.

Analysis : Simons and Pilbeam (1965) considered *Proconsul* as a subgenera of *Dryopithecus*, and included three species viz., *Dryopithecus nyanzae*, *D. africanus* and *D. major*. Whether or not we attribute generic or subgeneric status to various finds, what is more important to be noted is the presence or absence of certain distinguishing characters in the various dryopithecines in time range. It is difficult to draw an arbitrary boundary between the Miocene and Pliocene, especially when, there is a gradual intergradation of faunal elements and geological boundaries are not very well established. Among the Indian material, only the mandible of *Sivapithecus aiyengari* (*S. indicus*) from the Nagri beds seems to approximate with that of *P. major*, in so far as the dimensions and proportions are concerned. It is generally agreed that along with *S. indicus* this species may be considered ancestral to modern *Gorilla gorilla*. Simon and Pilbeam (*Op. cit.*) pointed out "from the available material, this species might almost equally be referred to the present day genus from which it differs mainly in having a less distinct simian shelf". The large third molar in *Proconsul major* recalls that of *Sivapithecus giganteus* from the Siwaliks but their affinities can not be judged as the Indian material is too scanty for detailed palaeontological analysis. An upper third molar (*Palaeosimia rugosidens*) referred by Pilgrim is rather suggestive of some of the much reduced M^3 of *P. africanus*, though the cingula is not well developed. Simons and Chopra (1969) recovered for the first time a well preserved lower jaw of *Gigantopithecus* from Dhokpathan beds. The status of this find is still uncertain.

DRYOPITHECINES FROM CHINA

The hominoid material recovered from the coal-fields near Keiyuan, China has been described in considerable detail by Woo (1957, 1958) and Chow (1958). Faunal associations give evidence of their Miocene age. Chow suggested that one of the finds from Yunan is similar to "*D. indicus*" and the other from close to or the same as *Ramapithecus* (non dryopithecine) *punjabicus*. However, additional data is required to evaluate the Chinese material.

HOMINID STATUS OF *RAMAPITHECUS*

A new genus and species was erected by Lewis (1934) on the basis of a well preserved maxilla and associated dentition. The provenance of this maxilla was in dispute for long time and only recently the writer (1964) made a correct appraisal. Substantial evidence (for the exact location of the maxilla) came forth from the clarifications made by Lewis and Krynine on the nature of the matrix. All these evidences combined with the author's intensive field work in the Haritalyangar area, has reinforced the conclusion that the *Ramapithecus* material is essentially from the Chinji and Nagri beds and obviously not Tatrots as previously suggested. Morphological studies of the available material give evidence that it was a progressive hominid. Though the canines are missing, the alveolus give sufficient proof that they must have been small and antero-posteriorly compressed. The reduced premolars coupled with simple low crowned molars and the dental arcade (arcuate) are suggestive of progressive species of hominid affinity. One of the recent finds is a maxilla (G.S.I. 18064) with the three molars assignable to *Ramapithecus brevirostris*. In the harmonius size reduction of the molars (all of equal size) and in the absence of cingulum, this recalls that of certain later hominids. Several teeth and fragments of mandible in the collection of the Geological Survey of India and Yale Peabody Museum, were assigned to *Dryopithecus* by Pilgrim or *Bramapithecus* by Lewis. Simons and Pilbeam (*op. cit.*) found the mandibles of *Bramapithecus* indistinguishable from *Ramapithecus* and assigned them to *Ramapithecus punjabicus*. Critical studies of the various finds reveal that *Ramapithecus* in the Siwaliks is not monotypic. The symphysial structure, the mandibular height with reference to the size of the molars are rather suggestive of a different species. Pilgrim

(1910) could not evaluate the mandibles (G.S.I. D-118, D-119) and erroneously assigned them to *Dryopithecus*. Similarly, Lewis observations were also very tentative. *R. punjabicus* appears to have been a short faced species smaller in size to *R. brevirostris*. The facial disposition of *R. punjabicus* seems to have been different but unfortunately, we can not evaluate the facial structure in the absence of complete anterior dentition. The difficulty in assigning the maxilla D-185 to *R. punjabicus* is due to the first upper premolar having three roots, a feature, which is considered primitive and recalls that of Pongidae. However, Clark (1955) opines that in some modern races of *Homo sapiens*, a small percentage shows three roots. Faint cingular structure are also seen in the mandibles. The reduction of the premaxilla is probably related to the recession of the jaws. Canine suppression and anterior dental reduction in hominids which are different from Pongids have evolved after considerable experimentation during late Cenozoic times. Canine was not an effective weapon of defence and its function was correlative with food habit.

At this stage, the use of dental elements and hand seems to be complimentary. The extensive use of tools (ad-hoc tool user) by *Ramapithecus* apparently for hunting has been advocated sometimes without skeletal evidence. The author (1974) has also suggested that the lingual aspect of the jaw which is relatively thin and hollow probably accommodated a mobile tongue unlike in contemporary dryopithecines. Critical evaluation of dental remains of *Ramapithecus* indicate that a free movement of the tongue was possible which could ultimately give expression to various modes of sounds and initiate some form of speech a specialisation possibly accomplished in Australopithecines and *Homo erectus*. At this stage it may be suggested that these South Asian Mid-Tertiary hominids had evolved a facial and dental mechanism both functional and evolutionary, which was a precursor for progressive development of these characteristics in later hominids a clue sufficiently culled from *Ramapithecus* remains.

The prevailing hydrography, the existence of subtropical climate supporting a wide belt of forests of flowering plants constituted the main feature for the abundance of primate life during the Cenozoic. The Pontian in India experienced dry climate and supported a new fauna including Cercopithecoids. The changing environment, probably affected the hominoid population and consequently new forms are known from these deposits. Faunal exchange between Eurasia and Africa during early and late Cenozoic need further study. The palaeoecology of South-Asian Cenozoic Primates has been discussed in considerable detail by the author (1971b, 1973) in two suggestive papers.

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