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Comparison of early primate skulls from Rudabánya (Hungary) and Lufeng (China)

By

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Abstract. This paper contains a comparative morphological analysis of the 10 myrs old Rudapithecus hungaricus (Rudabánya) and on the 7 myrs old Sivapithecus lufengensis (Lufeng) skull finds. The skull finds registered as RUD-77 and P.A. 677 show considerable similarity in the cerebral regions while there are basic morphological differences in the characteristics of the facial parts of the skulls. These similarities and differences between the two skulls also reveal the relation between the taxa Rudapithecus hungaricus and Sivapithecus lufengensis. With 2 tables, 1 list and 7 figures.

The Rudapithecus skull from Rudabánya and that of Sivapithecus lufengensis found at Lufeng are distinguished finds even among the important bone and teeth remains representing the process of early prehominization. At Rudabánya (NE Hungary) the ape remains were found in 10 million years old (Lower Pannonian = Late Miocene, Early Vallesian MN 9 zone) lignite and clay layers which had deposited in a contemporary swamp (KORDOS, 1982, 1985).

The first finds were discovered in 1967. Until the autumn of 1987 eighty primate find-associations had been found (KRETZOI 1969, 1974, 1975, 1976a, b, 1984: KRETZOI & al., 1976, MORBECK 1983; KORDOS 1987a, b), labelled as "RUD" and with serial numbers ranging from 1 to 80 (List 1). On the basis of our present knowledge the author's opinion is that the Rudabánya locality yielded two kinds of early primates, namely Pliopithecus hernyaki KRETZOI and Rudapithecus hungaricus KRETZOI (KORDOS 1987b).

The 7-8 million years old (Middle Baodian = Late Miocene, Middle Turolian, MN 12 Zone) layers at the site Lufeng in Southern China had deposited in a valley. Just as in Rudabánya, grey clay layers alternate in this locality with lignite stripes (QI GUOQIN 1985, CHENG WANYOUNG 1986). During the 9 excavation campaigns between 1975 and 1983, five skull fragments, 10 mandibles, 49 skull and mandible fragments, 28 toothrows, 650 isolated teeth, two knuckles, one scapula and one clavicle were found (WU RUKANG & al. 1986). According to Chinese experts, certain Lufeng finds, earlier reffered to Sivapithecus yunnanensis belong to male apes while the other ones, earlier referred to Ramapithecus lufengensis, are the remains of female animals. Therefore recently the name Sivapithecus lufengensis has been used for both taxa (WU RUKANG & al. 1986). Because of the differences between the Lufeng finds and the genus Sivapithecus, the introduction of a new generic name has recently been suggested (WU RUKANG, pers. comm. October 1987).

The remains found at the localities Rudabánya and Lufeng have special importance in the study of the process of prehominization in Eurasia because so far they are the only sites to yield skulls (Fig. 1, for measurements see Table 1).

In the autumn of 1987 I had the opportunity to spend one month in China within the scope of a cooperation programme between the Ministry of Geology and Mineral Resources (Beijing) and the (Central Geological Institute, Budapest), when I studied the original Chinese finds, especially the skulls and mandibles of female apes. I visited the Institute of Vertebrate Paleontology and Palaeoanthropology of Academica Sinica and consulted with several

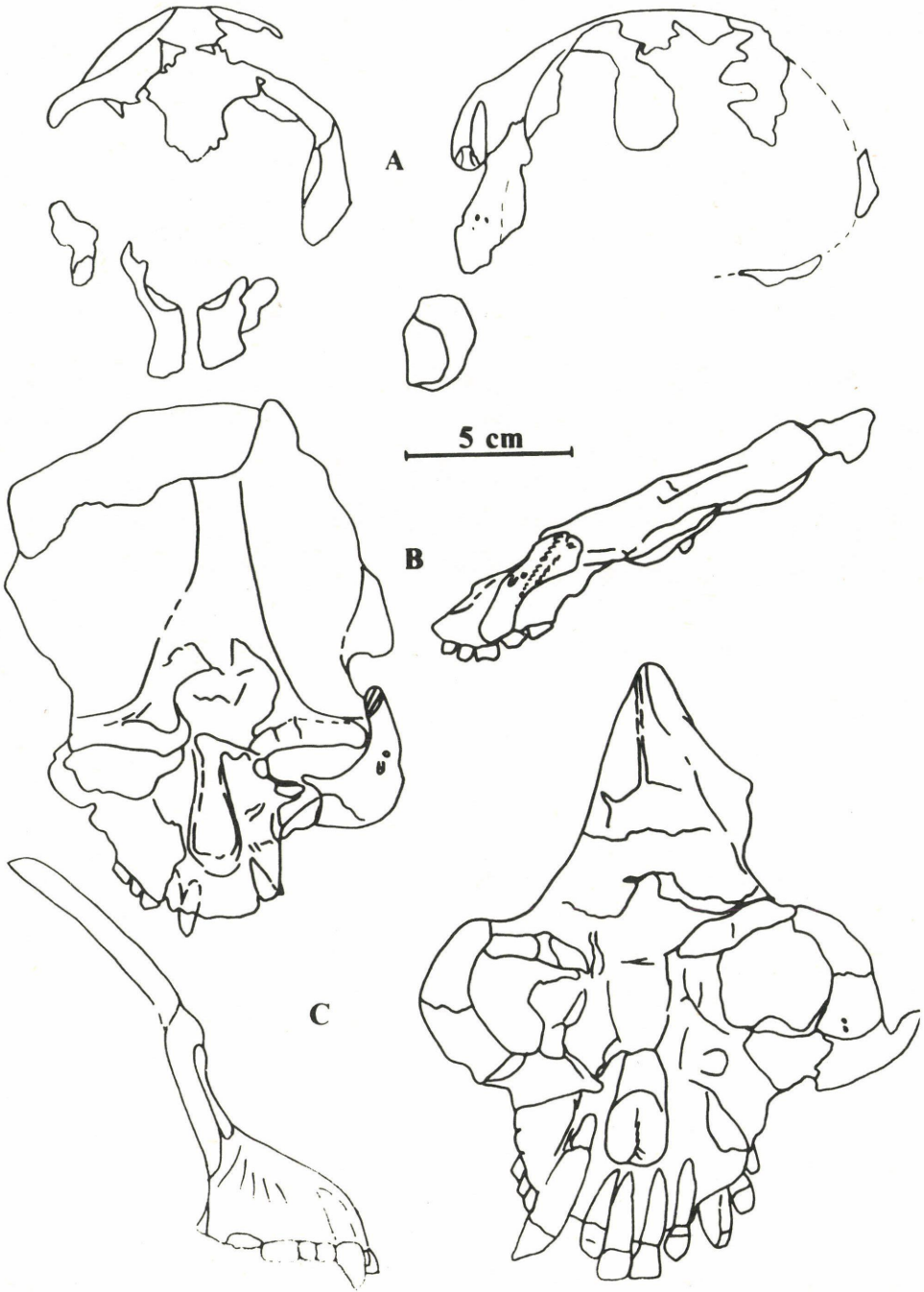


Fig. 1 Frontal and lateral views of the Rudapithecus hungaricus (A) and the Sivapithecus lufengensis skulls. B = P.A. 677., C = P.A. 644

Chinese experts on the comparison of Chinese and Hungarian finds. I wish to express my sincere thanks here to Professor WU RUKANG, LU QINGWU, HAN DEFEN, QI GOUGIN XU QINGHUA, QIU ZHUDANG, WU WENYU and LI CHUAN-KUEI for their assistance and readiness to cooperate.

Table 1 Measurements of Rudapithecus hungaricus (RUD-77) and Sivapithecus lufengensis (P.A. 677) (in mm)

Measurements	RUD-77	P.A. 677
Length of neurocranium	± 128	-
Half width of cranium at the eurion	40	42
Minimal distance of the frontale (ft-ft)	40	± 40
Mid-facial width at the zm	35	48
Width of the orbit (left)	± 28	33
Height of the orbit (left)	± 35	± 25
Interorbital distance	17	22 (reconstr.16)
P^3 length	6.4	6.2
P^3 width	10.0	9.1
P^4 length	6.6	7.2
P^4 width	10.2	10.6
M^1 length	8.8	10.6
M^1 width	± 9.4	10.6
M^2 length	9.4	11.4
M^2 width	11.1	11.3
M^3 length	9.1	10.6
M^3 width	10.6	11.0
M^1-M^3 length	27.7	-
P^3-M^3 width	40.4	-
Height of the palatine at the M^1	7.2	-
Lingual distance between M^3 and M^3	32.4	-

MATERIALS

The Rudapithecus skull find RUD-77 from Rudabánya consists of 101 bone fragments and 8 upper teeth. During its reconstruction in 1986, the frontal bone was completed by joining 24 fragments (direct bone-to-bone contacts). To the frontal bone the following parts are attached: the zygomatic bone, a fragment of the occipital bone (which, however, cannot be joint to it directly), a small piece of the basis, the subnasal maxillary bone (it possibly does not correspond to the facies anterior of both sides), the toothrows of both sides (left side P^3-M^3, right side M^1-M^3) with a fragment of the palatine (KORDOS 1987b).

According to WU RUKANG & al. (1981) the Sivapithecus lufengensis skull find P.A. 677 "is an almost complete skull, only the mandible was missing. The maxilla has in situ all teeth, except the two medial incisors, the left lateral incisor and the right canine. The

whole skull was compressed into a flat piece in the vertical or top-base direction during the process of fossilization, but with almost all parts intact".

TOP VIEW OF THE SKULL AND THE TEMPORAL LINES

The calvaria of the Rudapithecus skull practically belongs to the frontal bone. The sutures had been ossified to such a great degree that it is impossible to follow their track by the traditional methods. Consequently at present we are unable to make any anatomical distinctions among the other bones of the brain-case.

The distinction of sutures in the Lufeng find is not easy either. This skull is considerably compressed. Still, its right side can be studied well, thus giving an authentic picture of the find. With the aid of a sagittal mirror image of the right side, and with a slight correction a highly probable reconstruction of the top view of the calvaria results (Fig. 2). Projecting on each other in the same scale the main top view contour lines of the two reconstructed calvarias of the two skulls, we may prove that (1) the basic forms of the two calvaries are completely identically (2) the temporal lines cover each other completely in the supraorbital part of the frontal bone (frontotemporale) and near the lambda, (3) in the bregma region the distance between the temporal lines is narrower in the Rudabánya find than in the Lufeng one, (4) in the P.A. 677 find the opisthocranion is broken and missing, being therefore unsuitable for comparison, (5) there are no traces of sagittal crest on either skull, (6) the interorbital distance is wide on both specimens; (7) in frontal view the width of the orbits measured between the maxillofrontale and the sutura frontozygomatica is the same on the right side of both specimens but on the left it is narrower in the Rudabánya find, (8) the width of the skull (euryon distance) and its length (nasion-opisthocranion) are slightly (approximately by 8-10 % larger in the Lufeng find than in the one from Rudabánya.

Considering all these, it is highly probable that-in this comparison - this minimum dimensional and morphological difference between the two skulls is due to the damage of the Lufeng skull. That find had suffered compression from upwards and became flattened. The RUD-77 and P.A. 677 remains are completely identical as regards the basic morphology and dimensions of their calvariae.

THE QUESTION OF THE GLABELLA AND THE SUPRAORBITAL TORI

The glabella of the RUD-77 find is smooth, without any traces of supraorbital tori. This is of phylogenetic significance in the later phase of the evolution of primates, as well as in the process of hominization (KORDOS 1987a, b).

A clear recognition of these important marks is rather difficult on the Lufeng find P.A. 677. According to the formulation given by WU RUKANG & al. (1986): "The supraorbital ridges are slightly developed and uncontinuous with wide and concave glabella region". On the basis of the published photos, I found a difference between Rudapithecus and Sivapithecus lufengensis (KORDOS 1987b); namely, the supraorbital tori are more marked in the case of the Chinese skull than in the Rudabánya skull.

After the investigations made on the original Lufeng find P.A. 677 in China, I realized that the compression resulted in the collapse of the glabella region, therefore it is very difficult to reconstruct its straight or concave direction. Henceforward, it is hard to form an opinion on a possible presence or absence of supraorbital tori in the Chinese skull. It is certain that behind the more compact, thicker bony matter of the supraorbital bone, the thin frontal bone had been considerably pressed in and broken. That is why on the photos (WU RUKANG & al. 1981, 1986) the presence of supraorbital tori seems to be unquestionable. However, it is more probable that, although compared with the RUD-77 find the supraorbital tori are definitely observable in the Lufeng skull, they had developed only to a slight degree. This is corroborated by the fact that the bony matter of the torus can be well distinguished from the contact line of the frontal bone. Before a complete reconstruction of the skull, it is impossible to decide whether there was a depression between the two bones in the external surface. It is clear that reconstructions which attempt to demonstrate the presence of strong supraorbital tori in female Sivapithecus lufengensis are mistaken because they start from the present compressed condition of the find.

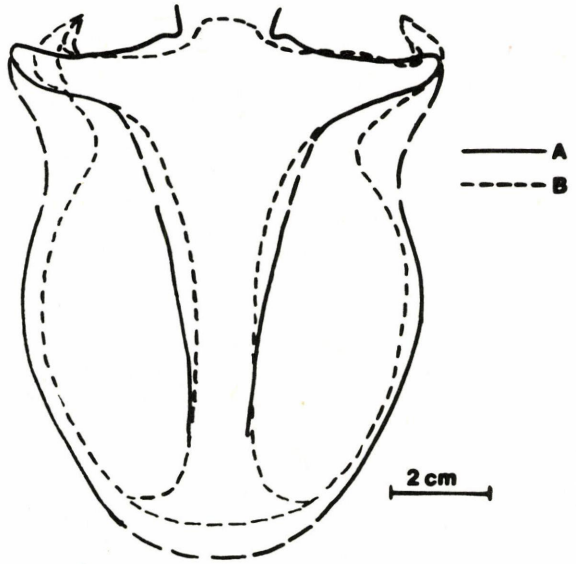


Fig. 2 Reconstructed top view of the Rudapithecus (B) and the Sivapithecus lufengensis (P. A. 677) skulls (A)

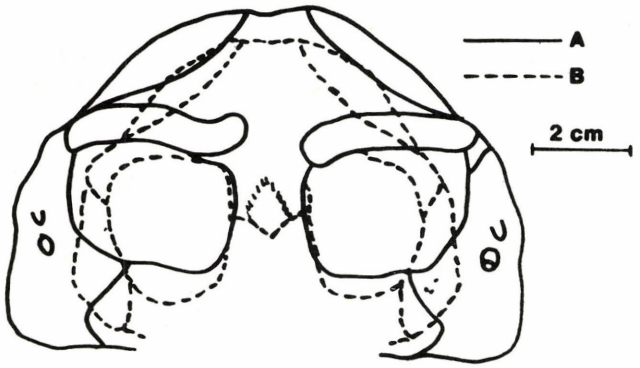


Fig. 3 Frontal view of the orbital region of the Sivapithecus lufengensis (P. A. 677) (A) and the Rudapithecus hungaricus (B). Reconstructions

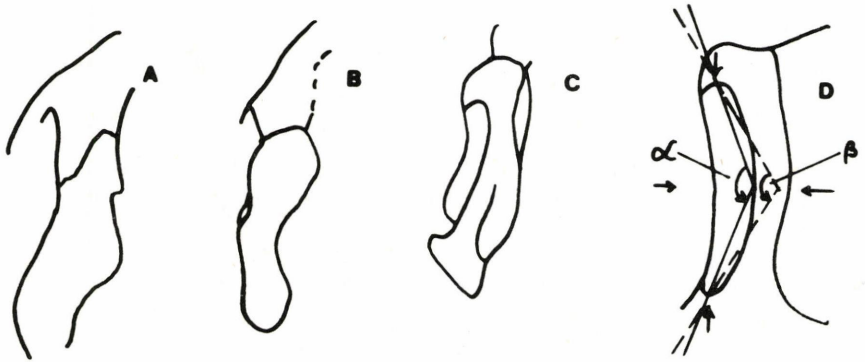


Fig. 4 Lateral view of the zygomatic region. A = Rudapithecus hungaricus, B = reconstructed P. A. 677 (S. lufengensis), C = S. lufengensis (P. A. 644), D = recent chimpanzee with the measuring points and arches

COMPARISON OF THE ORBITAL REGIONS

In the RUD-77 skull the bones bordering the orbits from above (supraorbital margins) and laterally (facies orbitalis) had remained intact in the left part, while the infraorbital margin is missing. The relative position of the two orbits is clearly delimited by the interorbital region and the glabellar region of the frontal bone. Therefore we may state that the orbits of the RUD-77 skull are connected to each other by a relatively wide interorbital region (1), the width of the orbit was smaller than its height (2), and it was probably "D" shaped (Fig. 3).

On the P.A. 677 skull belonging to a female Sivapithecus lufengensis, the glabella of the frontal bone and several margins of the orbit are already deformed; they have moved from their original position. After the study of the original find the following steps became necessary in the course of the reconstruction of the original position of the orbit:
(1) To connect the superciliar arch (which had pressed into the orbit) with the left side zygomatica in a view which may correspond to the frontal view (this could be achieved with a relatively great accuracy).
(2) To mirror the contour of the left-side orbit to the right side in the centre line of the face. It also makes it possible to correct the supraorbital and lateral arches of the right orbit. The infraorbital region is more complete in the right orbit than in the left one, therefore it is more reasonable to reconstruct the left side based on the right side.
(3) It became clear from the superior view of the calvaria that as a result of a compression from above, this part of the skull had become slightly flattened at the frontal bone. The divergence from the original condition is of 8-10%. After comparing the Lufeng skull with the RUD-77 find, I have come to the conclusion that it is probable that the width of the two skulls measured at the sutura fronto-zygomatica had been nearly the same. If we fit this measuring point of the undistorted Rudapithecus skull on the Lufeng skull a position is obtained which affords the same possibility for comparison for both skulls (Fig. 3).

The results of this reconstruction process is the following: The width of the orbit in the P.A. 677 find is larger by approximately 30% than its height. The orbit is rectangular, with rounded corners - as given in the original description (WU RUKANG & al. 1986). Another statement of the same study is that the interorbital region is very wide. After making the last step of the reconstruction process described above, this distance diminished considerably becoming identical with the respective distance in the RUD-77 skull. As compared to Sivapithecus indicus (GSP 15 000) and recent orang-outang this characteristic of the skull can still be considered very wide. Projecting on each other the reconstructed orbital regions of the Rudabánya and Lufeng skulls (Fig. 3) the following essential differences can be demonstrated: (1) the basic froms of the orbits are dissimilar, (2) in frontal view the frontal bone of the find P.A. 677 is higher than this bone in the RUD-77 skull, (3) the zygomatic bone of the Lufeng find is wider than the respective bone of the Rudabánya skull.

LATERAL VIEW OF THE ZYGOMATIC REGION

The bony frame which borders the orbit from outside consists of the processus zygomaticus of the frontal bone and the processus frontalis of the zygomatic bone. The two bones are joint by the sutura frontozygomatica. The relative position of these bones, connected with the development of the supraorbital tori is a very important evolutionary trait. Its importance has already been emphasized during the investigations carried ont on the Rudapithecus skull (KORDOS 1987a, b).

Generally speaking, these bones in Neogene finds (Proconsul africanus, Rudapithecus hungaricus, Sivapithecus indicus) are situated in an approximately straight plane. From the early Australopithecus finds to Homo sapiens in lateral views a characteristic arch of the orbit has developed. This arch is formed by a backward bend of the process of the zygomatic bone and by a forward bend of the processus frontalis of the frontal bone. Since no lateral perspective of the Lufeng finds has been published in the literature, in itself it does not afford any possibility to study this characteristic. Now the examination of the original finds P.A. 677 and P.A. 644 ones makes it possible to carry on this analysis. In the P.A. 677 (female) skull the processus frontalis, together with the superciliar arch, had been pressed into the orbit as results of pressure from aboved. At the same time they did not suffer any

distortion and the zygomatic bone remained intact in its original position. As for the male skull (P. A. 644), this region remained without any distortion in spite of the considerable co-pression of the skull.

In addition, a graphic superposition the main phases of the process was carried out simply by using certain angles for measurements (Fig. 4). (1) I defined the upper and lower inflexion points of the bony orbit as the two endpoints of a reference line, (2) another reference plane was obtained by drawing a perpendicular to the line between the above-mentioned two points, (3) the anterior point of contact of the bony orbit and this second plane forms the origin of an angle enclosing the upper and lower points of the orbit value, (4) the origin of the β angle is the point of intersection of this same second plane and the longitudinal central line of the processus frontalis, enclosing the two vertical extreme points of the orbit, (5) γ angle is the arithmetic mean of α and β. The results of this comparison made on some investigated skulls are given in Table 2.

Table 2

The angles of the zygomatic region

Taxa	α	β	γ
Sivapithecus indicus (GSP 15 000)	167	152	160
S. lufengensis (P. A. 677)	164	118	141
S. lufengensis (P. A. 644)	146	132	139
Orang-utang (recent)	150	125	137
Rudapithecus hungaricus (RUD-77)	149	122	135
Proconsul africanus	136	125	130
"Zinjanthropus boisei"	135	115	125
Chimpanzee (recent)	131	117	124
Australopithecus africanus (Taung)	123	110	116
"Plesianthropus transvaalensis"	130	98	114
Petralona	130	87	108
Broken Hill	121	93	107
Steinheim	120	92	106
Gorilla (recent)	120	90	105
Jebel Irhoud	120	88	104
Homo sapiens (recent)	115	85	100

Even the scanty data make it possible to distinguish different evolutionary phases and trends, especially as regards the γ value. The Rudapithecus and the Chinese finds are in the same group. They are isolated from the Sivapithecus indicus-orang-outang line, as well as from the trend of decrasing angle values which can be observed in a later phase of hominization.

After the comparison of the Rudabánya and Chinese primates finds we may say that in lateral view the bones which border the orbits laterally show considerable similarity in their development.

SAGITTAL SECTION OF THE SUBNASAL REGION

It is very simple to study the subnasal alveoral morphology of Rudapithecus hungaricus. The RUD-77 maxilla find was broken vertically along the median palatine suture, therefore the palatine process of the maxilla, the lateral margin of the nasal aperture, the anterior nasal spine, the naseoalveoral clivus, the prosthion, the infradentale and the oral and nasal incisive fossae (WARD & KIMBEL 1983) can be examined very well. If it is impossible to study directly the sagittal section in a find, usually X-ray and computerized tomography (CT) investigations are applied (WARD & KIMBEL 1983; DE BONIS & MELENTIS 1987; CONROY & VANNIER 1987). In the case of the Lufeng finds the subnasal alveoral morphology has been stuied so far. During this comparative investigation I made attempts to draw the mid-sagittal section of male Sivapithecus lufengensis (P. A. 644) with the aid of casts (Fig. 5).

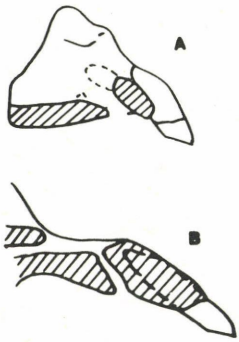


Fig. 5 Sagittal section of the subnasal region.
A = Rudapithecus hungaricus (RUD-12),
B = S. lufengensis (P. A. 644)

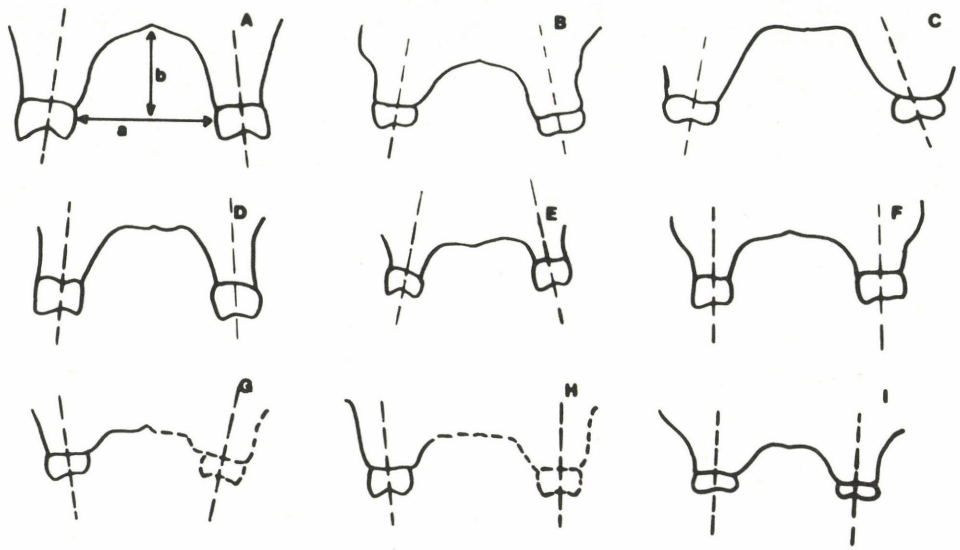


Fig. 6 Vertical section of the different hominoid-hominid remnants, with the measuring points of the depth of the palatine, and the trend of the molar axis. A = recent orangutan, B = Sivapithecus indicus (GSP 15 000), C = S. lufengensis (P. A. 644), D = gorilla (recent), E = chimpanzee (recent), F = Homo sapiens (recent), G = Rudapithecus hungaricus, H = "Bodvapithecus", I = Australopithecus africanus (Taung)

As WARD & KIMBEL (1983) wrote in their classic paper this cluster of traits makes possible to distinguish two or three types among the Miocene hominids. The "Asian" form includes Ramapithecus, Sivapithecus indicus and recent Pongo, while Proconsul africanus from western Kenya, Australopithecus afarensis from the Hadar Formation of Ethiopia as well as recent African apes belong to the "African" type. According to the authors clearly "African" subnasal pattern occurs in a late Miocene hominoid specimen recovered at Rudabánya. A possible third group may cover some Australopithecus forms.

In the Lufeng find P.A. 644 the oral fossa incisiva is narrow and is situated in the line of P^4. The nasoalveolar clivus is long and has a curved surface between the prosthion and the anterior nasal spine. The nasal crest projects over the palatine process. Comparing it with the RUD-12 find, it can be seen that in the Rudabánya find the subnasal region is shorter than in the Lufeng one, the naseoalveolar clivus is ovoid and not elongated, the fossa incisiva is wide and is situated at the height of the canine, on the naseolaveolar clivus the anterior nasal spine emerges considerably over the plane of the palatine process.

Summing up the results of these preliminary investigations, it may be stated that as regards its subnasal alveolar morphology, the Sivapithecus lufengensis skull (P.A. 644) of Lufeng belongs to the "Asian" type rather than to the "African" one. RUD-12 belongs to the "African" type and in this group it is similar first of all to Rangwapithecus vancouveringi (KNM-SO 700) and Australopithecus afarensis (A.L. 199-1. and A.L. 200 1a).

VERTICAL SECTION OF THE MAXILLARY BONE

The dome-like rise of the palatine was regarded as an important morphological difference between the two pongohominid taxa (Rudapithecus hungaricus and Bodvapithecus altipalatus) of Rudabánya described by KRETZOI (1974, 1975). As I have emphasized before (KORDOS 1987b) it was a mistake to distinguish a Rudapithecus species with a palatine of "low" position and a Bodvapithecus species with a palatine of "high" position among the Rudabánya finds. The height of the palate measured at the respective teeth in practically the same in both taxa, it has a low position at M^2. This can be seen in both RUD-77 and RUD-12 and it can be reconstructed with great probability also in the type of "Bodvapithecus altipalatus" (RUD-7 find).

As for the Lufeng finds this section was observable only in the male specimen (P.A. 644) in which, compared to the Rudabánya finds, the dome-like rise of the palatine is considerably higher (Fig. 6). An index is used here to denote it in figures. This index is obtained by dividing the distance between the lingual sides of both M^2-s ("a" value) by the distance between this line and the palate, measured along a line perpendicular to the middle of the line ("b" value). The results are the following:

Specimen	"a" (mm)	"b" (mm)	index
Rudapithecus (RUD-12)	27	9	3.0
Rudapithecus (RUD-77)	±31	±12	2.6
S. lufengensis (P.A. 644)	43	22	2.0
S. indicus (GSP 15000)	30	15	2.0
Australopithecus africanus (Taung)	26	11	2.4
Pongo (recent)	34	23	1.5
Pan (recent)	27	11	2.5
Gorilla (recent)	32	14	2.3
Homo sapiens (recent)	30	13	2.3

After this brief outline we may state that Rudapithecus (including "Bodvapithecus"), chimpanzee and modern man belong to a group with "low" palate. Recent gorilla, with its rising palate, together with Australopithecus africanus, occupies an intermediate position between the previous group and those forms which have definitely high palate (Sivapithecus indicus, S. lufengensis and recent orang-utang). Thus from evolutionary viewpoint in this respect the Rudabánya finds are nearer to chimpanzee and modern man than to the Sivapithecus indicus and Chinese lufengensis which have several characteristics in common with each other.

With the aid of the vertical section of the maxilla it can also be demonstrated that in Rudapithecus the sagittal axes of the M^2 teeth converge toward the mandible while in all other extinct or recent apes investigated so far they diverge. At the same time they are more or less parallel in man and in the "Taung baby" (Fig. 6). The very strong lingual attrition on the M^1 and M^2 teeth of the RUD-77 skull is by all means due to this. It is highly probable that the converging type was the more archaic one. The "Asian" type had already abandoned this trait by 6-8 myrs. Probably the same development took place in the chimpanzee+gorilla line from 5-6 myrs onwards. However, strongly diverging axes did not develop during the process of hominization.

THE MAXILLARY DENTAL ARCH

The maxillary dental arch - in accordance with changes in the cerebral part of the skull - is a characteristically changing morphological trait, though it does not denote specific differences. A very probable reconstruction of the maxillary dental arch of Rudapithecus had already been carried out before by using RUD-12 and RUD-77 finds (KORDOS 1987b). The result is a regular "U-shaped" arch. The M^3-P^3 teeth are situated in a straight line and the two dental rows are parallel to each other. The curvature of the dental row begins at the canine.

The dental arch of the female Sivapithecus lufengensis (P.A. 677) had not been reconstructed so far, because as a result of compression the bones of the maxilla, together with the teeth, had moved from their original position. After a detailed study of this find one may try to reconstruct the original dental arch.

During this reconstruction the starting point was given by the horizontal part of the palatine with the M^2-M^3 teeth on both sides (Fig. 7), because they have remained in their original form. The fragment of the right-side bony palate with the M^1-P^3 teeth has slightly shifted over this part. Taking into consideration the contact surfaces of M^1 and M^2, this fragment could be joint to the earlier separated fragment of the palatine. The original find has been broken and removed in the line of the right canine and it is distorted at the incisive teeth. Taking into account other Lufeng finds during the reconstruction process, it became clear that the jointing of this part resulted a diasteme between the canine and the lateral incisives. I made several possible reconstructions for the dental arch but they differ from each other only in insignificant details. In all these versions the P^3-M^3 teeth are in the same axis and the two dental rows slightly diverge toward the M^3. They became considerably narrower at the frontal arch. Therefore the maxillary dental arch does not show the regular "U" form but it is a transitional form between "U" and "V" shapes.

It is only the frontal part of the maxillary bone of the Lufeng male skull (P.A. 644) (Fig. 7) which has remained without distortion. This part (together with the canines and incisive teeth) shows the same reduced form which appears in the female specimen. The P^3-M^2 toothrows diverge considerably. All these phenomena suggest the existence of a marked sexual dimorphism within the same taxa among Chinese finds.

Summarizing the present knowledge of the maxillary dental arch of Rudapithecus hungaricus and Sivapithecus lufengensis, one may state that the Rudapithecus find, which is 3-4 million years older than the Lufeng one, seems to be more "modernized". In addition there are fundamental morphological differences in the frontal arches of the two finds.

COMPARISON OF TEETH FROM RUDABÁNYA AND LUFENG

While the anatomical analysis of the Lufeng teeth has been already published (WU RUKANG & al. 1985, 1986), only part of the Rudabánya teeth have already been described (KRETZOI 1975, KORDOS 1987b). However, even this comparison, based on a relatively few finds, is enough to draw attention to some morphological peculiarities. The central incisor of Sivapithecus indicus is twice as large as the lateral incisor. At the same time this difference is not observable in Rudapithecus hungaricus, where the incisors are practically of the same measurements. The sagittal measurement of the alveole of RUD-12 is 7.7 mm for the central incisor and 7.0 mm for the lateral one. Consequently, the latter tooth is smaller only by 9-10% than the central incisor.

In the Chinese finds there is a diasteme between the canine and the lateral incisor. In the Rudabánya finds this hiatus is very small (RUD-12, -15).

In both groups of finds the canines of the females are small. In the Lufeng finds the premolars are wider than in the Rudabánya finds, especially in the talon region. The succession of the measurements of the molars is the same in both groups, namely, the crown of M^2 is the largest, followed by those of the M^3 and M^1 teeth.

The linguo-buccal cross-sections of the crown surfaces in premolars and molars show significant differences. In the Rudabánya find on both sides the enamel bends highly upwards, enciroling a deeply arched, concave region. In the Chinese specimens this arch is flatter, the crowns are more "flattened".

The M^3 of the RUD-77 find is not rectangular but rather of a trapezoid form which becomes narrower backwards. The respective tooth in P. A. 677 is rather quadratic. This basic form of M^3 in all the investigated Rudabánya specimens (RUD-18, RUD-45, RUD-77) is identical. In the Chinese finds, however, this shape varies (e. g. P. A. 658 in WU RUKANG & al. 1985). The following differences may be observed in the morphology of the occlusal surfaces of the upper teeth: the cusps and the ridges are sharp in the Rudabánya finds and in the adult specimens the fossae do not contain smaller plicas and tubercles. The opposite can be observed in the Lufeng upper teeth.

RESULTS

Comparison of the Lufeng and Rudabánya female skulls led me to conclude the following essential morphological similarities and differences:

- the basic forms of the calvarias are identical
- the developments of the temporal lines are identical
- there is no sagittal crest in either finds
- the interorbital distance is wide in both specimens
- the supraorbital tori are absent in RUD-77 but to a slight degree present in P. A. 677
- there are significant differences in the shape of the orbits. They are D-shaped in the Rudabánya find while in the one from Lufeng they are rectangular with rounded corners
- in Sivapithecus lufengensis the frontal bone is higher in frontal view than in Rudapithecus hungaricus. The zygomatic bone is wider in the Chinese find than in the one from Rudabánya
- the zygomatic regions are very similar to each other in lateral view
- the subnasal alveolar region belongs to the "Asian" type in the case of the Lufeng find and to the "African" type in the case of the Rudabánya skull
- on the basis of its palate height, Rudapithecus belongs to the "low palate" group while Sivapithecus lufengensis belongs to the "high palate" group
- in frontal view the axes of the upper teeth converge downward in the Rudapithecus find but they diverge in the Lufeng one
- the maxillary dental arch of the Rudabánya skull is "U-shaped", but it is slightly "V-shaped" in the Sivapithecus lufengensis skull
- there is a great difference in the measurements of the central and lateral incisors of Sivapithecus lufengensis, while their measurements are the same in Rudapithecus
- in the Chinese finds the diasteme between the canine and the incisor is large, while in the Rudabánya find it is smaller
- the molars differ from each other as regards their linguobuccal sections and the micromorphology of their occlusal surfaces.

Summarizing the investigated characteristics, I may state that in the cerebral regions there is a great similarity between RUD-77 and P. A. 677 skulls while as regards the morphology of the facial parts, fundamental differences can be observed. These similarities and differences between the two skulls represent also similarities and differences existing between the taxa Rudapithecus hungaricus and Sivapithecus lufengensis. The Rudabánya find, which is the older one - together with the European finds - and the younger Lufeng (SE-Asian) early apes have such evolutionary characteristics which are manifested in a deceleration of the development of the cerebral region of the skull and in an important morphological-phylogenetical development of the facial part.

On the basis of all these I conclude that Rudapithecus hungaricus is not identical with Sivapithecus lufengensis, neither could it be the direct ancestor of the Chinese form.

List 1

List of the Primates from Rudabánya

RUD-1	Mandibular ramus sin. (with P_4-M_3) - Holotype of Rud. hung.
RUD-2	Demaged mandible (with C-M_3 dext. and sin.)
RUD-3	Molar (M_1 or M_3) dext.
RUD-4	C sup. sin. (male)
RUD-5	P^3 dext. (germ.)
RUD-6	M^1 sin.
RUD-6	Maxillary fragment with P^4-M^2 - Holotype of Bodv. altip.
RUD-8	C sup. sin. (female)
RUD-9	Fragments of mand. dext. and sin. (with C, D_4, P_4-M_2 dext. and M_1-M_3 sin.) - Holotype of Plio. hernyaki
RUD-10	P^3 sin.
RUD-11	M_2 dext. (germ.)
RUD-12	Left maxillary and palate (with I^1, C-M^1)
RUD-13	M^2 sin.
RUD-14	Mandibular fragments (with I_1-P_4, M_1-M_2 dext. and I_1-C, P_4-M_2 sin.)
RUD-15	Left maxillary (with I^1-M^2) and fragments of right one (with I^1-M^2)
RUD-16	M_3 dext.
RUD-17	Corpus of left mandible with C-M_3 and fragments of left mandible with I_2-M_3
RUD-18	M^3 sin.
RUD-19	M_3 sin.
RUD-20	C sup dext. (female)
RUD-21	Distal fragment of left humerus
RUD-22	Ulna prox. fragment
RUD-23	Caput of the left femur
RUD-24	Distal end of the left femur (it is not Primates)
RUD-25	Proximal end of the left tibia (it is not Primates)
RUD-26	Patella
RUD-27	Left astragalus, without head (talus in MORBECK 1983)
RUD-28	Phalanx
RUD-29	Distal end of metapodial
RUD-30	Phalanx
RUD-31	Distal two-thirds of phal. I.
RUD-32	Distal part of phal. I.
RUD-33	Medial fragment of phal. I.
RUD-34	Phalanx
RUD-35	Medial fragment of phal. I.
RUD-36	Distal part of phal. II.
RUD-37	Distal part of phal. II.
RUD-38	Phal. I., proximal end missing
RUD-39	Distal half of phal. I.
RUD-40	Medial fragments of phal. I.
RUD-41	Diaphysis of phal. I.
RUD-42	Medial fragment of phal. I.
RUD-43	Proximal end of phal. III.
RUD-44	Left maxilla with palatine, C, P^3-P^4 and M^2; and fragment of the frontal bone
RUD-45	Right M^1 and M^3
RUD-46	P_4 fragment
RUD-47	I^1
RUD-48	Lower M (? M_3)
RUD-49	Two lower molars
RUD-50	Associated teeth (9 specimens)
RUD-51	P^3
RUD-52	Two incisivi
RUD-53	Upper molar
RUD-54	Phalanx dist. fragment
RUD-55	Femur fragment
RUD-56	Phalanx

RUD-57 Metatarsal fragment
RUD-58 M^2
RUD-59 Distal end of phalanx
RUD-60 Proximal end of distal phalanx
RUD-61 Lower teeth from the same animal
RUD-62 It is not Primates (probably Suidae)
RUD-63 Distal end of phalanx
RUD-64 It is not Primates
RUD-65 C (germ.)
RUD-66 Radius ep. fragment
RUD-67 C
RUD-68 I, two lower molars
RUD-69 M_3 (?)
RUD-70 Premolar
RUD-71 Orbitofrontal region of the face fragment with C-M^3 - Holotype of Rangwapithecus (Ataxopithecus) serus
RUD-72 Talus
RUD-73 Premolar
RUD-74 Phalanx fragment
RUD-75 Phalanx fragment
RUD-76 M^2
RUD-77 Skull fragment with left P^3-M^3 and right M^1-M^3
RUD-78 Phalanx fragment
RUD-79 Premolar
RUD-80 Phalanx fragment

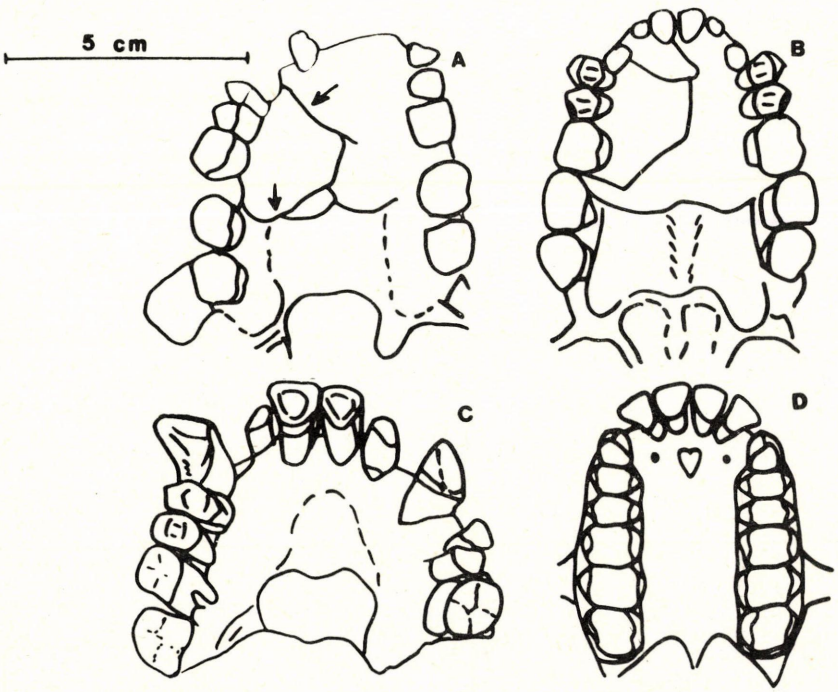


Fig. 7 The maxillary arch. A = original situation of the Sivapithecus lufengensis (P. A. 677) maxillary arch and after the reconstruction (B). C = Original arch of the male S. lufengensis (P. A. 644), D = Reconstructed maxillary dental arch of the Rudapithecus hungaricus

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