JEAN S. AIGNER AND WILLIAM S. LAUGHLIN

THE DATING OF LANTIAN MAN AND HIS SIGNIFICANCE FOR DISCERNING TRENDS IN HUMAN EVOLUTION

ABSTRACT

The Lantian* fossil hominid cranium from southern Shensi, China, provides the earliest record of Homo erectus in northern east Asia, and is morphologically the most primitive specimen in the entire world. Importantly, the Kungwangling Lantian cranium (calvarium plus face), with associated stone tools in good geologic and palaeontologic context, is both earlier and more primitive than the Choukoutien I remains. Faunal and palynological evidence support a mid-Mosbachium equivalent age (some 700.000 years).

The Chenchiawo Lantian mandible like the Choukoutien I remains, is attributable to the Holstein-equivalent in China (some 300.000 years ago), and should therefore no longer be temporally associated with the Kungwangling cranium. However, the mandible may be morphologically associated with either, a fact which calls attention to the relative independence of the mandible in human evolution. Continuing selection for a masticatory complex with large jaws provides another point of continuity between fossil East Asian and modern Asian and Bering Sea Mongoloids. The absence of third molars adds to the suggestion that Chinese fossil hominids display traits which reach high frequencies in Mongoloid populations today.

A number of morphological features of the cranium, especially vault thickness, cranial capacity and reinforcement system, conform to expectation and confirm a general trend of reduction in vault thickness and reinforcement system with increase in cranial capacity over time within the single human species. Extrapolation of this long term trend backward suggests that an older form might be even thicker, with a more massive reinforcement system and smaller cranial capacity. If this should be the case then the known Australopithecines would seem to be excluded as immediate, though not as ultimate, precursors of humans. If a 700.000 year date is used, then the rate of humen evolution with respect to these features can be viewed as relatively rapid.

* *Lantien or Lant'ien in the literature*

RELATIVE DATING OF THE HOMO ERECTUS REMAINS FROM LANTIAN, CHINA

INTRODUCTION

Among the most interesting and important hominid remains recovered in China in the last decade are the mandible and cranium from the Lantian district of southern Shensi (Fig. 1). These fossils

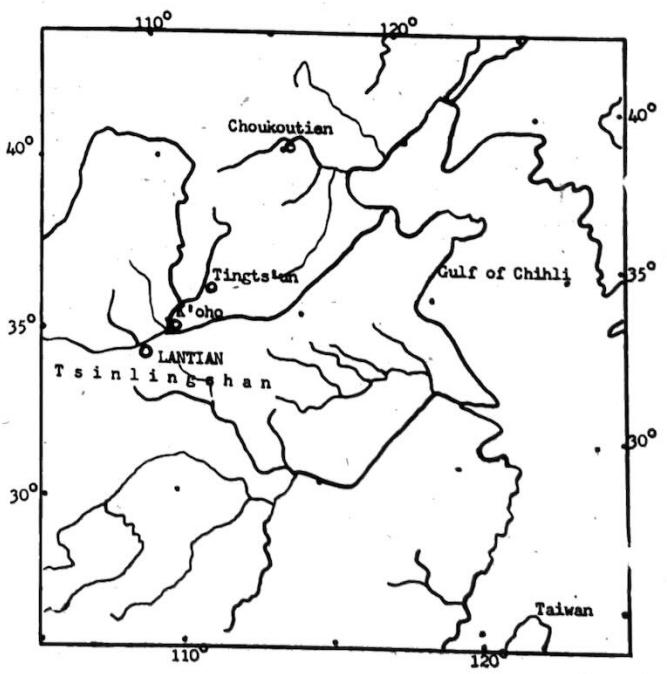

FIG. 1. *Map locations*

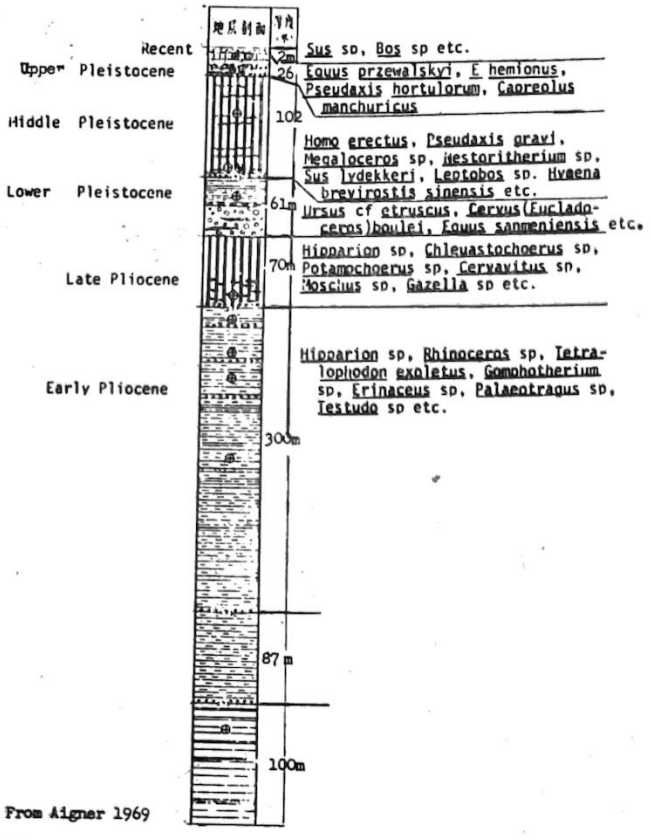

FIG. 2. *Lantian*

provide useful additions to the collection of north Chinese Homo erectus remains, heretofore known primarily from Choukoutien, and one provides considerably more time depth for this form in northern east Asia.

It was in the course of palaeontological reconnaissances west of Sian near the Paho between 1959 and 1963 that the Chenchiawo mandible was recovered (J. K. Woo 1964a, 1964b; Tang 1964; Y. P. Ch'ang et al 1964) and further palaeontological and palaeoanthropological work in the area recovered the Kungwangling cranium (Huang and Ch'ang 1966; IVPP 1966). The relative dating of the two specimens and their temporal relationship to Choukoutien locality 1 and within the Chinese Pleistocene sequence, which are not adequately documented in western literature, constitute one part of this paper. Furthermore, a brief examination of the geologic and palaeontologic context and associations of the specimens serves to update and augment the standard western summaries of Pleistocene cultural and faunal stations known through 1937 (Teilhard 1941; Movius 1944, 1948; see Aigner 1972).

The final section of this paper assesses the significance of the Lantian materials in terms of hominid evolution in general, and Mongoloid phylogeny in particular.

GEOLOGIC CONTEXT

Palaeontologically, deposits in the Lantian area are rich and they are internally divisible both lithologically and faunistically. A generalized Middle Pleistocene section in the Lantian area includes 100 m of reddish clay (with several intercalations) on top of 4 m or more of gravels which rest in turn upon pre-Pleistocene deposits (Fig. 2).

In the Lantian area, but evidently not at a single locality, Lower, Middle and Upper Pleistocene strata may be defined. It should be noted that in recent publications Chinese geologists persist in compressing the Middle Pleistocene into a so-called pluvial and later inter-pluvial phase, corresponding to the Mindel and Holstein of the old European terminology (IVPP 1966; Chang 1968). This leaves earlier post-Tiglian phases unaccounted for or subsumed within the Chinese Villafranchian. It also forces a consideration of all Middle Pleistocene remains as roughly contemporaneous, a practice which has confused the dating of the Lantian hominids (Aigner 1969, 1972).

In Lantian, Upper Pleistocene strata are seen to occur on terraces against high (Middle Pleistocene) hills of reddish clay. Consisting of sands and gravels, the deposits have revealed both artifacts and mammalian remains including a modern looking Homo sapiens (Tai and Chi 1964).

RELATIVE DATING OF THE LANTIAN HOMINID LOCALITIES

CHENCHIAWO LOCALITY 63709

Chou (1964) and others (Y. P. Ch'ang *et al* 1964; Woo 1964a, 1964b, 1964c) described the small collection of mammalian fossils from the Chenchiawo locality. In addition to the original list which includes the hominid mandible and macrofossils, new material consisting mainly of microfossils was excavated in the summer of 1964 (Chou and Li 1965) (Table I).

It is important to note that Ochotonoides complicidens of the original lists actually derives from levels below the rest of the fauna. Key to dating the remains is the absence of any Lower Pleistocene (Chinese Villafranchian) "survival" and the presence of forms nearly all of which are found at Choukoutien localities 1 and 13, or at those partly contemporaneous K'oho stations (Aigner 1969, 1972). Only the presence of Myospalax tingi (Siphneus tingi in older Choukoutien lists) suggests an equivalence with Choukoutien locality 13 and with the lowest levels at Choukoutien locality 1, attributable to the early part of the Holstein equivalent in China.

KUNGWANGLING LOCALITY 63706

In 1964 as work in the Lantian area proceeded, a second human fossil was uncovered along with associated stone artifacts and faunal remains. The hominid remains include a skull cap, isolated teeth and several other fragments (Woo 1965a, 1965b, 1965c, 1966a, 1966b; Anonymous 1965; Chou, Hu and Li 1965; Wu *et al* 1966).

Faunal form	Kungwangling	Chenchiawo	Kóho	Choukoutien 13	CKT 1
Homo erectus	×	×	3	3	×
Neomys. spp.	×				×
Myospalax spp.		×		×	×
Apodemus sylvaticus		×			×
Ochotonoides complicidens		4			?
Ochotonoides spp.				×	×
Lepus spp.		×			×
Stegodon sp.	5		×		
Palaeoloxodon sp.		×	×		×
Tapirus sp.	×				
Equus ? sanmeniensis[1]	×				
E. sanmeniensis				×	×
Nestoritherium cf sinense	×				
Rhinocerus sp. (?sinensis)	×				
Sus lydekkeri	×	×		×	×
Elaphodus cephalophus	×				
Cervus (Rusa) sp.	×				
Megaloceros konwangliensis	×	?			
Pseudaxis grayi		×	6	6	×
Gazella sp.	×				×
Leptobos sp.[2]	×				
Bison sp.			×		×
Hyaena brevirostris sinensis	×				×
Meganthereon sp.	×				×
Panthera cf pardus	×				×
P. tigris		×			×
Acinonyx pleistocaenicus	7				
Acinonyx sp.				×	×
Mustela spp.	×			×	×
Meles leucurus	×	×		×	×
Cuon spp.		×		×	×
Nyctereutes sinensis	×			×	×
Ursus thibetanus	8				×
Ailuropoda sp.	×				×

[1] *A small, perhaps more primitive form*
[2] *Recalls Bison priscus*
[3] *Presence inferred from tools*
[4] *Actually from levels below the rest of the fauna*
[5] *S. orientalis or S. praeorientalis*
[6] *Apparently distinguishable from the same form at Choukoutien locality 1*
[7] *Larger than the Villafranchian form*
[8] *Somewhat primitive*

All the fossils studied come from a single quarry or "fossil pocket" referred to as locality 63 706. The station is situated at the northern slope of the Kungwangling hill, a spur of an extensive loess platform at the northern foot of the Tsinling on the south side of the Paho (see K. C. Chang 1968, Fig. 12). The Paho is a tributary stream which enters the Hueiho near Sian some 45 km distant.

The mammalian remains (Table I) were found near the concretionary basal part of the reddish clays overlying a series of sandy gravels which are underlain disconformably by Pliocene red sandy clays containing Hipparion and Chilotherium. The gravel bed reaches a thickness of 33 m; it may be mainly Pleistocene in age (Y. P. Ch'ang *et al* 1964). The fossiliferous reddish clays are 28 m thick in this area and the top of the Pleistocene section is about 100 m above the Paho.

In sections from this locality the Chinese show five buried soils, distinguished into 12 levels numbered 1—12 from bottom to top. These are broken down into the youngest soil 5 (levels 12—11), soil 4 (levels 10—9), soil 3 (levels 8—5), soil 2 (levels 4—2) and soil 1 (level 1). The underlying 33 m of gravels are divided into an upper 3—5 m zone of early Middle Pleistocene age and a lower 30 m of Lower Pleistocene gravels (Wu *et al* 1966).

The series of buried soil contained the hominid skull cap and mammalian fossils in level 6 and stone artifacts above in levels 8 and 7, all in soil 3. These remains are considered by the authors to be nearly if not exactly contemporaneous.

In our opinion on faunistic grounds the Kungwangling locality also containing H. erectus must be considered temporally earlier than Chenchiawo, K'oho, Choukoutien 1 and 13 (Aigner 1966, 1969, 1972). Important among the faunal forms present at the Kungwangling Lantian locality (Table 1) are Ursus thibetanus which in some ways recalls *U.* cf. etruscus, the ancestral form from the Chinese Villafranchian, Nestoritherium (a brachydont chalicothere), a new (Chinese) Megaloceros sp., and common Leptobos. Southern elements are common in the fauna. But remains are not abundant, each form being represented by only a few identifiable bones, save Pseudaxis which is fairly common and Leptobos which is especially well represented.

Southern elements in the fauna include Ailuropoda, Stegodon, Nestoritherium, Tapirus, Elaphodus and Rusa; nearly all of these were previously thought to be absent in the north of China during the Pleistocene. Their presence at Kungwangling north of the Tsinling may be due to the more southerly location of the site and / or to its geologically relatively early age. That is, uplift forming the now effective Tsinling barrier may have occurred within the Pleistocene after these fauna moved north. Insufficient knowledge of the Pleistocene in this area permits no definitive statement.

The majority of species (60 per cent) represented at Kungwangling are known from Choukoutien localities 1 and 13 but 42 per cent are also known in the older Chinese Villafranchian fauna of Nihowan. Only 37 per cent are modern forms compared to 50 per cent at Choukoutien locality 1. These proportions indicate the noncontemporaneity of the Kungwangling and Choukoutien localities.

Palaeoecologically, the mammalian assemblage of Kungwangling shows a dominance of forest and woodland forms with fewer grassland forms represented (the actual number of individuals represented is generally too low to be meaningful). With the exception of Leptobos, Equus and Pseudaxis the majority of species present are represented by only a single specimen or specimens belonging to a single individual. Most of the remains of the forest-preferring animals were evidently washed down from upslope, which was wooded, and buried with the other fossils in the residual reddish clays.

Climatologically, the Kungwangling fauna is typically one of warm temperate or subtropical climate, the effect of which seems to have been more pronounced than on the fauna of Choukoutien locality 1. There is some scant palynological data from the two Lantian localities which tend to support an interglacial age for both (Hsu 1966). The pollen and spore counts, like Vasari's at Choukoutien locality 1 (Kurtén and Vasari 1960), are too poor for detailed reconstruction, but pollen present is mainly that of grasses and grassland plants with Pinus, Carpinus, Celtis, Ulmus, Quercus and Betula also represented. Hsu believes these trees were present on the hillsides above the fossil stations. The tree and shrub types present are indicative of temperate conditions.

Compared to the more extensive pollen remains collected by the Chinese in situ from Choukoutien locality 1, Hsu finds that the Lantian materials suggest a slightly warmer condition. At the present time the mean January temperature at Lantian is about 0.6° C (compared to —4.6° C at Peking) and the average annual temperature is near 14 °C (compared to 11.8 °C). He believes the modern figures fit well with the floral, faunal and geological interpretations and indicate the Lantian sites and also Choukoutien locality 1 belong to interglacial periods. This does not mean they belong to the same warm interval.

The palaeontological remains permit us to make a finer relative dating of the Lantian assemblages and to place them within a more detailed Chinese Pleistocene sequence. It is quite clear from a comparison of the Kungwangling fauna with those from relevant Choukoutien localities and from Chenchiawo that Kungwangling is older than the other faunas. The primitiveness of the hominid remains may be emphasized as confirming the dating based upon the primitiveness of the associated faunal elements. Choukoutien locality 1 and the contemporaneous Chenchiawo fauna are attributable to the Holstein equivalent in China (perhaps 300.000 B.P.) Kungwangling dates to an earlier interglacial period, most likely the middle Mosbachium (the Mauerer Waldzeit of perhaps 700,000 B.P.). The affinity of these hominid remains to the Djetis human, considered "Cromerian" in age, is also consistent with this dating (see below).

ARTIFACTS

In the early phase of work only one artifact attributable to the Middle Pleistocene came to light. It was found 1,000 m from the human mandible at Chenchiawo locality 63 709 (Fig. 3). The tool is a large, unifacially worked pebble which is roughly chiselpointed. Despite various attributions, it is not typologically similar to large pointed tools from either K'oho or Tingts'un in the Sanmen and middle Fenho regions, respectively. Nor is it similar to European hand-axes.

Subsequently, older artifacts were found in close geologic context with the Kungwangling hominid and fauna. From levels 8 and 7, just above the skull cap but in the same buried soil, several artifacts were recovered. These include a small flake with a corner projection and traces of use along one end, and a small utilized pebble (Tai 1966; Aigner 1966, 1969). Also in the collection are a large flake (16×12 cm) and four nuclei. One nucleus shows that a flat cortex face was used as the striking platform. Flake scars on this example measure 6 cm in length (Aigner 1969). (The photographs are too poor to reproduce here).

In strata probably equivalent to levels 8 and 7 but about 100 m to the east of locality 63 706 a small, naturally pointed flake with evidence of retouch or use was found with a nucleus. One kilometer to the southeast a large flake was found.

The remains from Lantian are too scanty to permit meaningful comparison beyond noting that the diagnostic artifact forms and techniques of flake production which characterize sites in the K'oho-Tingts'un region are absent at Lantian. No outstanding affinities with Choukoutien are evidenced either. But significantly, the Kungwangling artifacts, dating to the mid-Mosbachium equivalent and associated with a primitive H. erectus are the earliest tools in east Asia (Aigner 1972).

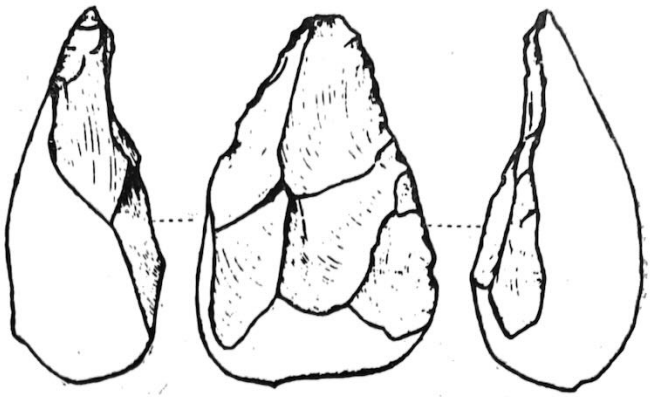

FIG. 3. *Pebble tool X 1/3 from Middle Pleistocene deposits from near Chenchiawo Lantian 63709 (Tai and Chi 1964)*

HOMINID REMAINS

CHENCHIAWO LOCALITY 63709

The Homo erectus mandible was recovered from deep in the reddish clays above basal gravels. It is very well preserved and complete, only a part of the rami being lost. All of the teeth remain in situ with the exception of the first premolar of the right side which was lost ante-mortem. The crowns of the canine, the two premolars and the first molar on the left side were damaged during the process of excavation. The third molars on both sides are absent.

Based on measurements of the mandible and teeth, Woo (1964a, 1964b, 1964c) concludes the remains are those of an adult of advanced age. In terms of mandible size the Lantian specimen falls into the range of Sinanthropus* females, but the large lower first molar is not within the range and precludes specific sex determination.

On the whole the Lantian mandible is considered morphologically similar to contemporaneous Sinanthropus from Choukoutien 1 though it has a smaller angle of inclination, a greater difference between the height of the symphyseal part and that at the level of the mental foramen, and a larger angle of the molar rows. The bony prominences such as the prominentia lateralis of the body and the crista ectocondyloidea and the torus triangularis of the rami are present but less marked than in Sinanthropus from Choukoutien 1. There is no torus mandibularis in the Chenchiawo mandible.

The size of the Chenchiawo teeth is generally larger than in Coukoutien 1. From roentgenograms no tooth germs for the third molars were found on either side, indicating to Woo that this is a case of congenital absence. According to him there is not enough space behind M_2 to accommodate the third molars. In addition, the buccal side of the alveolar process of the right first molar was markedly atrophied and its edge thickened. This is said to have resulted from the pathological changes of periodontoclasia. Other cheek teeth on the right side also show atrophy in the alveolar processes. No caries are in evidence.

KUNGWANGLING LOCALITY 63706

The fossil hominid material consists of articulated frontal, large parts of the parietal, the right temporal and the basal parts of the nasal bones, plus large parts of the right and left maxillae with the right second molar in situ, and the right third molar in distorted position. Later in the palaeontological investigations a left upper molar belonging to the same individual was recovered. The skull cap is slightly distorted by compression, but the general morphology is little affected (J. K. Woo 1966a, 1966b).

*) *We have folloved J. Woo (1966a) using the term Sinanropus to identify certain specimens of* Homo erectus. *Taxonomically Woo refers the entire Sinanthropus collection of Choukoutien to* H. erectus pekinensis, *the Lantian skull cap and mandible to* H. erectus lantianensis. *Woo is also inclined to view the Lantian fossils as contemporaneous but this follows the IVPP geologic-faunistic interpretation with which we do not concur for reasons elablorated elsewhere (Aigner 1969, 1972) and summarized above.*

On the condition of the teeth and suture closure, age of the individual is estimated by Woo as over 30 years; sex is difficult to determine though perhaps the smaller size of the teeth, maxillae and features of the pyramid of the temporal bone and middle cranial fossa suggest the remains are those of a female.

Supraorbital tori are very large and heavy and form a continuous bar throughout the glabellar region. They have the same general character as in Sinanthropus and *H. erectus* from Java. But contrary to the condition in Sinanthropus, the tori are not separated from the squama by a distinct sulcus and the torus glabellaris projects somewhat more forward. The postorbital constriction is more pronounced than in either the Java or Choukoutien forms.

The forehead is very low and distinctly receding. As in all of the later Sinanthropus skulls there is a cross-like elevation where the coronal and sagittal sutures meet. Because of the sharply receding forehead, bregma is situated almost vertically above porion; the temporal lines rise to real ridges.

One distinct peculiarity of the Lantian skull is the extraordinary thickness of the cranial wall (16 mm). Thickness is chiefly due to the enlargement of the external and internal tables and not to the diploë of the cranial bones. The maxilla is small and distinguished by marked alveolar prognathism.

Since the skull cap, right temporal and parts of the facial skeleton were preserved, it was possible to reconstruct the skull. Reconstructed length is 189 mm, breadth 149 mm and auricular height 87 mm—lower not only than Sinanthropus but also the H. erectus remains from both Djetis and Trinil Beds in Java. Woo provides two measurements of cranial capacity. Computed according to Pearson's formula, cranial capacity is 778 cubic centimeters. The biparietal vaults measured 417.6 cc, and based on the proportion of the total endocast volume to the biparietal endocast in early hominids (the method used by Tobias 1971), Woo obtained a figure of 775—783 cc as the total endocast volume of the skull. Both measures are remarkably close.

The masive supraorbital ridges, pronounced postorbital constriction, low frontal squama and cranial height, extraordinary thickness of the cranial wall and small cranial capacity indicate this form is more primitive than either Sinanthropus or H. erectus from Trinil. It is morphologically closer to the earlier hominid from the Djetis Bed of Java although more primitive even than that form in certain respects. We concur with Woo's morphological evaluation.

SIGNIFICANCE OF THE LANTIAN HOMINID REMAINS

Using the morphological features cited above, it is clear that the primitiveness of Kungwangling is in agreement with our earlier dating of the skull. It is not so satisfactorily accommodated by the Chinese assessment of later age. Of the various features of the Lantian cranium, the cranial capacity, vault thickness and reinforcement system are of special importance because they provide confirmation of the morphology of earliest true human.

If we use the geological sequence to order the data, and therefore place Lantian and Homo erectus erectus from the Djetis beds of Java together as the geologically oldest and approximately equivalent members of the series, we then find an excellent progression. Cranial capacity increases (Table II), the vault becomes thinner (Table III) and the reinforcement system is reduced. The reduction of the reinforcement system (supraorbital torus, sagittal elevation, suprameatal crest and occipital torus) is discussed by Weidenreich (1943) and by Aigner and Laughlin (1973).

Of particular interest is the observation, "The thickness of the cranium is chiefly due to the enlargement of the external and internal tables and not to the diploë of the cranial bones." (Woo 1966a). An important characteristic of modern humans is the elaboration of the diploëtic tissue of the vault. It provides a site for the manufacture of red cells as well as for the venous circulation. In response to various diseases it may become hyperostotic and communicate directly with the external surface (Hamperl and Laughlin 1959; Hamperl and Weiss 1955; Hooton 1930: 316—318).

The principal trends, extending from this earliest Homo erectus, through the later Chinese forms in north and south China, Neanderthal in Europe, Solo in southeast Asia and Rhodesian in Africa to modern humans generally, have been set forth in a variety of works. Thus, our cranial evolution has involved (a) expansion of the brain, (b) thinning of the vault bones, (c) reduction of the reinforcement system, (d) flexing of the cranium, (e) enlargement of the anterior tympanic plate, and (f) the formation of new features or enlargement of existing features (chin, suborbital fossa, elevation of nasal bones, articular eminence, etc.) (Laughlin and Osborne 1967: 209—210).

When these trends are extrapolated backward in time it becomes apparent that major changes between the Australopithecines and Homo erectus took place with remarkable speed, or that the immediate precursors of Homo erectus have yet to be recovered. The vault bones of the known Australopithecines are relatively thin whereas those of fossil humans are thick. The reinforcement system of Homo erectus is substantial whereas only Australopithecus (Paranthropus) robustus has a major reinforcement system and it is of quite different character (Aigner and Laughlin 1973).

The Chenchiawo Lantian mandible is of later age, geologically and faunistically, than the Lantian cranium. That it can be associated morphologically with either the Lantian cranium or the Choukoutien erectus skulls may provide an interesting commentary on the relative indepedence of the mandible in human evolution as well as in ontogenetic growth.

The absence of third molars, confirmed by x-ray, may be added to the list of traits showing continuity between Chenchiawo Lantian erectus and modern humans and with the Mongoloid populations in particular.

Sequence in cranial capacities of HOMO ERECTUS *when ordered by geological time* TABLE II

Series		Mean Capacity	Context
Homo erectus pekinensis	(n = 5)	1043 cc	Main Choukoutienian = "reddish clays"
Homo erectus erectus	(n = 5)	881 cc	Trinil Bed
Lantian cranium and *H. erectus erectus* (Robustus IV)	(n = 2)	765 cc	Mid-Mosbachium = lower "reddisch clays" = Djetis Bed = "Cromer"

These values for cranial capacity are the same as those cited in Table 13 of Tobias (1971: 90). Djetis Homo erectus erectus (= Robustus IV) has been deleted from the Trinil-Sangiran series because it is geologically older, and placed in the lower middle Pleistocene series with Homo erectus from Lantian. The mean of 881 cc for the Homo erectus erectus series of Trinil context is then based on five specimens rather than the six cited in his table.

Summary of cranial thickness (1) TABLE III

Measurement	Lantian	*Homo erectus erectus* (2)	*Homo erectus pekinensis*	"Classic Neanderthal"	*Homo sapiens sapiens*
Os frontale	N	N	N		
center of squama	5.0 (1)	8.0 (2)	9.3 (8)	6.8	6.5
facies temporalis	7.0 (1)	3.75 (2)	5.3 (7)	4.5	1.5
Os parietale near Bregma	16.0 (1)	9.33 (3)	8.8 (5)	7.7	5.5
Os temporale center of squama	11.5 (1)	8.0 (1)	8.0 (6)	6.5	1.9
Total	49.5	29.08	31.4	25.5	14.95
Average thickness	12.37	7.27	7.85	6.37	3.74

(1) All values except Lantian man from Weidenreich 1943: 163, (in mm).
(2) Not including H. erectus = Robustus IV
N = number of specimens

The above Table omits measurements of the occipital bone, as such data are not present for Lantian. However, when the occipital thickness measurements for the others are included the progression remains intact: Lantian = (12.4)*, *H.* erectus erectus = 10.0, *H.* erectus pekinensis = 9.7, "Neanderthal" = 7.2, *H.* sapiens sapiens = = 5.2 (1)
* Not including occipital.

SUMMARY

To recapitulate—we have assigned the Kungwangling cranium to the Chinese lower Pleistocene (probably the Mosbachium-equivalent) on the basis of our interpretation of the faunal and geological evidence. The reassignment fits well with both the morphological configuration of the Djetis hominid and its geological antiquity. This temporal ordering both extends and confirms the continuity in the major trends of human evolution.

We have temporally separated the Chenchiawo mandible from the Lantian cranium, and on the basis of the geologic and faunistic comparison assigned it (as with Choukoutien I) to the Holstien equivalent in China. The fact that morphologically the mandible could be associated with either the earlier, smaller brained Lantian or with Sinanthropus is explained by and is in itself confirmation of the relative independence of the mandible in human evolution. Thus, the Chenchiawo specimen assumes considerable theoretical significance, a point we have elaborated elsewhere (Aigner and Laughlin 1973).

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