Hominids from the Lower Pleistocene
of
South China

Geoffrey G. Pope

For a number of reasons, the study of hominid evolution in China has always been a simultaneously fascinating and frustrating pursuit. Since the end of World War II and the disappearance of the largest single sample of *Homo erectus* fossils in the world, a large quantity of new information bearing on the presence of lower and middle Pleistocene hominids has been published. Similarly, new information about the faunas which shared the habitat of Pleistocene man has also been forthcoming. Unfortunately, the absence of K/Ar dating and the lack of paleomagnetic profiles in China has necessitated a reliance on the "character" of faunal assemblages and the "evolutionary stages" of various taxa as indicators of the chronological relationships of various hominid fossils. With the exception of the Lantian calotte and mandible, hominid fossils attributable to the lower Pleistocene (between 1.80 and .69 million years ago) are very rare. The oldest known fossils on the east Asian mainland come from two

localities in south China and consist of isolated teeth. While these specimens tell us little about the morphological evolution of *Homo,* their very presence indicates that by the early Pleistocene an early grade of *Homo* or a late grade of *Australopithecus* had already attained a wide distribution in the Old World.

Before 1965 and the discovery of the first fossils discussed in this paper (Yuanmou, Yunan), no hominids were definitely known from the lower Pleistocene of the southern faunal area (an area in China bordered on the north by the Qin Ling Mountains; see Figure 1). The lower Pleistocene (including the lower middle Pleistocene of Chinese palaeontologists) mammalian faunas are characterized by a number of presumably tropical and subtropical elements which shared a number of affinities with other faunas of southeast Asia. The *Stegodon-Aliluropoda* fauna, as it has been called, has been divided into earlier and later components according to (1) evolutionary grades of

1   YUAN MOU (including Banquo Basin)
2   XIN-SHE-CHONG
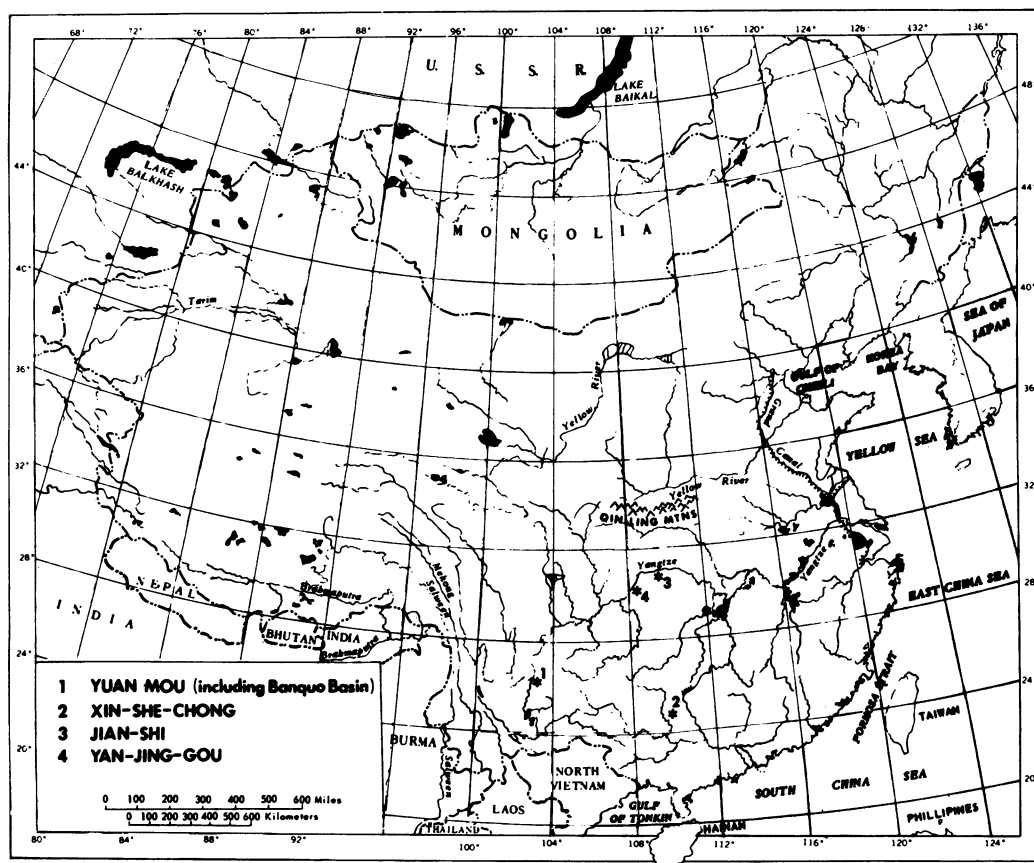3   JIAN-SHI
4   YAN-JING-GOU

Fig. 1 Pleistocene Faunal Localities of Southern China

the members of various phylogenies (primarily size) and (2) the first and last appearance of various taxa. These subdivisions which are based primarily on the work of Pei (1961, 1963 and 1965), Kahlke (1961) and Colbert and Hooijer (1953) may be summarized as follows:

Earlier
(possibly including the late Pliocene)

(1) *Pongo*
(2) *Gigantopithecus* (smaller teeth)
(3) *Ailuropoda* (smaller form)
(4) *Tapirus* (smaller form)
(5) *Stegodon praeorientalis*
(6) *Equus yunnanensis*
(7) Gomphotheriidae
(8) *Cuon* (larger form)

Later
(1) *Macaca* (first appearance)
(2) *Gigantopithecus* (larger teeth?)
(3) *Pongo*
(4) *Hylobates* (? first appearance)
(5) *Ailuropoda* (larger form)
(6) *Tapirus* (= *Megatapirus*)
(7) *Elephas namadicus*
(8) *Stegodon orientalis*
(9) *Cuon* (smaller form with well-developed metaconid)

It must be noted that Chinese palaeontologists seem to use a 3 million year long Pleistocene (in only one publication, Zhou and Zhang 1974, has this been explicitly stated). The beginning of the middle Pleistocene also remains undefined and the use of both epoch subdivisions varies with different authors. More recent authors seem to be using a "date" for the beginning of the Pleistocene similar to the one used in this paper. Additionally, some of the above listed taxa may be present in both epoch subdivisions in spite of the fact that they are currently unknown from one or the other. The assumption of rectilinear *phyletic* sequences and continuous change in size of these taxa has played a particularly important role in assigning relative ages to the members of presumed lineages. However *Tapirus* and "*Megatapirus*" probably do not constitute a single lineage (Colbert and Hooijer 1953) and both are known from the Trinil faunal zone. The presence of a large form of *Ailuropoda*, the presence of *Macaca* and the presence of *Elephas namadicus* may prove to be the best guide fossils for a period of time equivalent to the late lower Pleistocene or early middle Pleistocene. However, since there are few well-studied stratigraphic columns in south China and no radiometric dates, the use of first appearances is an extremely tenuous approach which cannot be verified.

Yuanmou (Mai-Kai Valley) is located on the Long-Chuan River on the northern part of the Yunan Highlands (see Figures 1 and 2). Here an extensive series (at least 370 meters thick) of fluviolacustrine deposits has been exposed. The strata consist of a number of sands, gravels, clays and river terraces (see Figure 3). The lower 140 m of the section of the Yunamou deposits which are overlain by riverine gravels contain pollen indicative of tropical or subtropical conditions (Hu 1973). The Yuanmou deposits may possibly cover a a time period which extends from the late Pliocene to the middle Pleistocene. Hominid incisors were recovered from deposits of brown, sandy clay situated approximately 59 m from the top of the section. Unfortunately, no explicit locality for the hominid remains is given in any of the literature. You and Qi (1973), however, state that the locality is in the vicinity of the village of Shang-Na-Bang and on the same stratigraphic level as locality 67003. While the uncertainty of the location of the finds points to a common frustration in assessing paleontological specimens in China, on the basis of the fauna and strata of localities 67001 and 67005 which reportedly are stratigraphically lower than locality 67003, a lower Pleistocene dating of the hominid fossils seems highly plausible (see Table 1). Presumably lower Pleistocene forms recovered from the two stratigraphically lower localities include *Equus yunnanensis*, *Stegodon zhaotungensis* and *Hyaena licenti*. The fauna from locality 67003 itself is not identified below *Cervus* spp., *Gazella* sp. and Bovinae indet. Of the above mentioned taxa, none can be definitely shown to be confined exclusively to the lower Pleistocene, but this may prove to be the case with *E. yunnanensis* and *S. zhaotungensis*. Few of the "characteristic" lower Pleistocene taxa of south China (i.e. *Ailuropoda*, *Tapirus*, *Gigantopithecus*, etc.) are present at these localities. This is due most probably to the fact that the portion of the Yuanmou deposits which contains the hominid incisors samples a cooler highland habitat. This interpretation is also supported by palynological evidence (Hu 1973).

TABLE 1
Fossils and Fossil Localities of the Yuanmou Basin
(From You and Qi 1973)

Taxa	*Fossil Localities*
Canis yuanmoensis	67001
Vulpes cf. *chiknshanensis*	67001
Felis tigris	67004
Felis pardus	67001
Cynailurus sp.	67004
Hyaena licenti	67001
Hyaena sp.	67004, 67006
Stegodon zhotungensis	67005
Stegodon sp.	67005
Equus yunnanensis	67001
Rhinoceros sinensis	67001
Sus scrofa	67004, 67006
Cervus sp. A	67001, 67003
Cervus sp. B	67001, 67002, 67003
Bovinae indet.	67001, 67003, 67004, 67006
Gazella sp.	67003
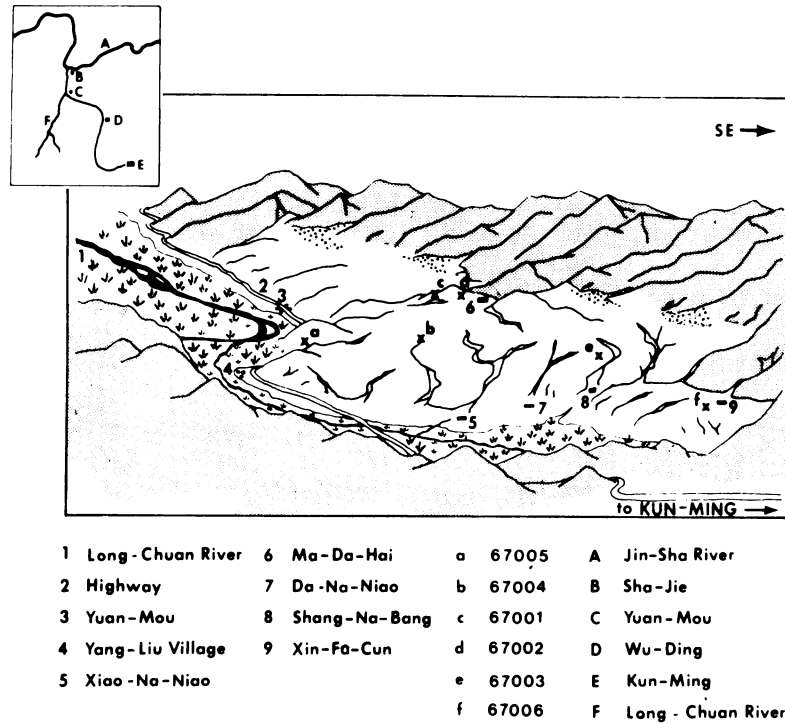
Fig. 2 Distribution Yuan Mou Quaternary Fossil Localities
Approx. Scale 1:50,000

(After You & Qi, 1973)

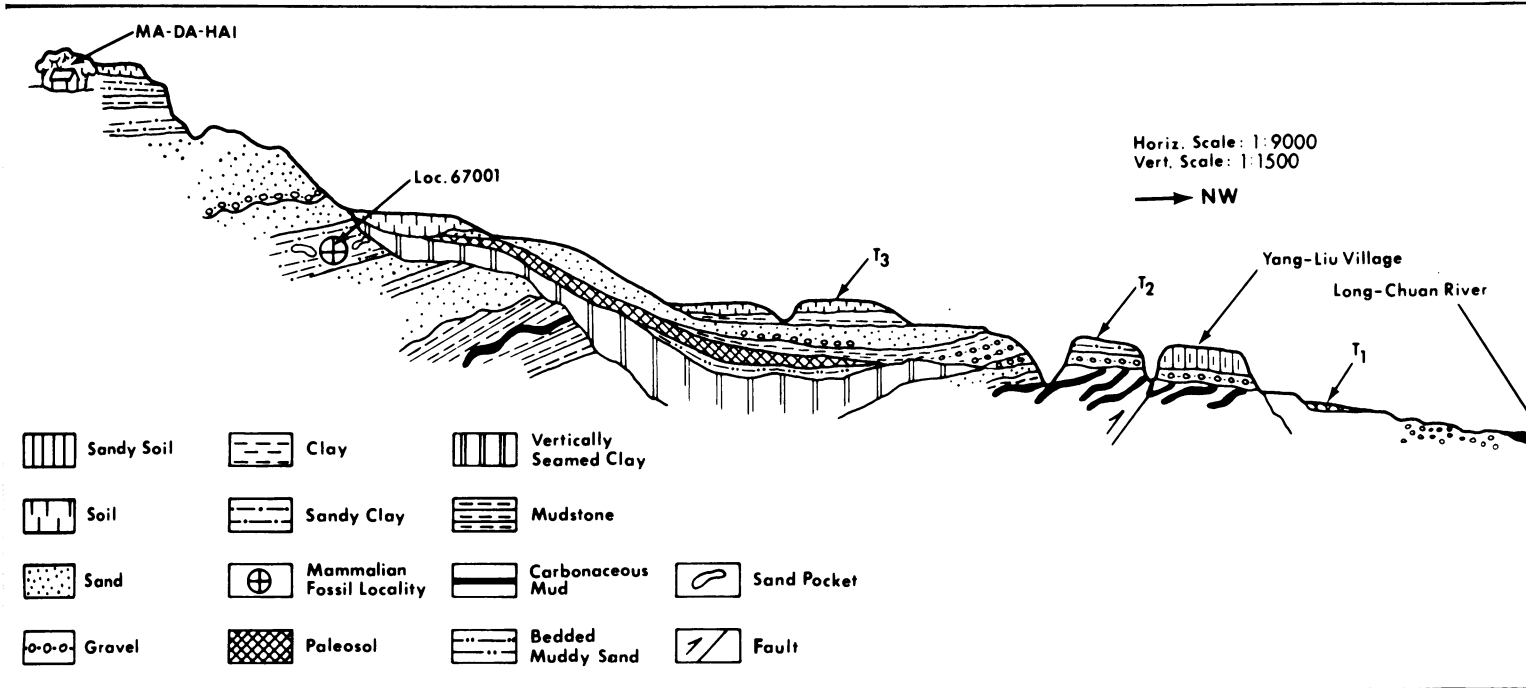| 1	Long-Chuan River	6	Ma-Da-Hai	a	67005	A	Jin-Sha River
2	Highway	7	Da-Na-Niao	b	67004	B	Sha-Jie
3	Yuan-Mou	8	Shang-Na-Bang	c	67001	C	Yuan-Mou
4	Yang-Liu Village	9	Xin-Fa-Cun	d	67002	D	Wu-Ding
5	Xiao-Na-Niao			e	67003	E	Kun-Ming
				f	67006	F	Long-Chuan River

Fig. 3 YUAN MOU BASIN — Cross Section from Ma-Da-Hai to Long-Chuan River

(After You & Qi, 1973)

Brief Description of the Yuanmou Incisors

The Yuanmou incisors are comparable in a number respects to the Zhoukoudian (= Choukoutien of the Wade-Giles System) *Homo erectus* incisors (described by Weidenreich 1937). The incisors are shovel-shaped and evidence a basal lingual tubercle (gingival eminence) and "finger-like prolongations" which are situated on the mesial and distal margins of the incisors. Both incisors are thought to represent upper central incisors belonging to the same individual. Although the Yuanmou incisors conform to the observable morphology of *"Sinanthropus"*, they are also differnet in a few respects.

While the incisor roots are round in cross section and robust in both the Yuanmou and "Sinanthropus" incisors, the Yuanmou roots are noticeably constricted at the neck. This trait adds to the overall triangular appearance of the crown of the Yuanmou specimen (Hu 1973). In absolute measurements (see Table 2), the left Yuanmou specimen is longer than "Sinanthropus" male and female speciments (Weidenreich 1937), the Sterkfontein Sts. 52a specimen (Robinson 1956), the B-27 Omo specimen (Howell 1969) and the AL 200-1a Hadar specimen (Johanson and Taieb 1976). In width, both the Yuanmou and "Sinanthropus" specimens are slightly smaller than the Sterkfontein and Hadar specimens. In length, the Yuanmou specimen is furthest from the B-27 Omo specimen from the Brown Sands area which lies within the range of australopithecines (Howell 1969). The Yuanmou specimen is closest in length to the right incisor of the Hadar palate which is comparable with other material; assigned to *Homo erectus;* especially "Pithecanthropus IV" (Johanson and Taieb 1976). In morphology as well as size the Yuanmou specimens are probably best assigned to an early form of *Homo erectus.*

Farther to the north, four lower molars have been recovered from the Badong and Jian Shi districts of Hubei. Three of these teeth (PA-504, PA-502, PA-503) were found in cave deposits in association with isolated teeth which have been assigned to *Gigantopithecus.* The fourth molar, PA-507, from the Badong district, lacks provenience. All have been referred to *Australopithecus.* Although they have been described as

comparing favorably with *A. africanus,* Gao (1975) has sugested that they represent a new Asian species of *Australopithecus.*

The cave deposits, which produced the PA-520, PA-503 and PA-504 molars, are characteristic of the Karst Cave deposits which are widespread in southern China (see Figure 4). The "dragon bone cave" itslef is located approximately 85 meters above Dragon Cave stream, a position characteristic of the older Karst Caves (see White 1974 for a review of the rationale regarding the temporal ordering of Karst Caves). The fossil content of the deposits is rather uniform regardless of level. The fossils were either washed into the caves by running water as suggested by Hsu, et. al. 1974 or deposited as a result of the bone collecting habits of *Hystrix.* The hominid and other mammalian fossils consist largely of isolated teeth. The hominid and *Gigantopithecus* teeth were recovered from the pruple-red clay layer marked by the second lowest fossil symbol in Figure 4. The brownish-yellow sandy deposits and the stratigraphically lower cemented yellow sands have produced exactly the same genera. The various strata probably do not represent discrete chronostratigraphic units.

The fauna of Jian Shi (see Table 3) has been termed "late lower Pleistocene" (?ca. 2 m.y. BP) and has been considered to be intermediate in age between the earlier Xin-She-Chong (Liu Cheng *Gigantopithecus* cave) and the presumably middle Pleistocene Yan-Jing-Gou (see Figure 1) fissure fauna near Wan Xian, Sichuan (Hsu et al. 1975). Among the primates, the presence of *Pongo* and the absence of *Macaca* is taken as an indicator of the lower Pleistocene age of the fauna. In size and morphology, the *Gigantopithecus* teeth are nearly identical to the Xin-She-Chong specimens. Among the carnivores, *Cuon* is smaller in size than the genus rep-

Table 2
Comparison of Measurements of Central Upper Incisors (mm)
(Modified from Hu 1973, with Additions)

		Yuanmou male (left)	"Sinanthropus" male (left) No. 4	"Sinanthropus" female (right) No. 2	Sterkfontein (left) Sts. 52a	Omo (right) B-27	Hadar (left) AL 200-1a
Crown	Length	11.5	10.7	9.8	9.5	9.2	10.8
	Width	8.1	8.1	7.9	8.2	--	8.3

Table 3
Jian Shi Faunal List

Gigantopithecus blacki
Cuon javanicus antiquus
Ursus sp.
Ailuropoda cf. *melanoleuca fovealis*
Arctonyx sp.
Hyaena licenti
Felis sp.
Machairodontinae
Gomphotheriidae
Trilophodon serridenstoides
Stegodon sp.
Equus yunnanensis
Tapirus sinensis
Rhinoceros sp.
Sus sp. A
Sus sp. B
Cervus sp.
Muntiacus sp.
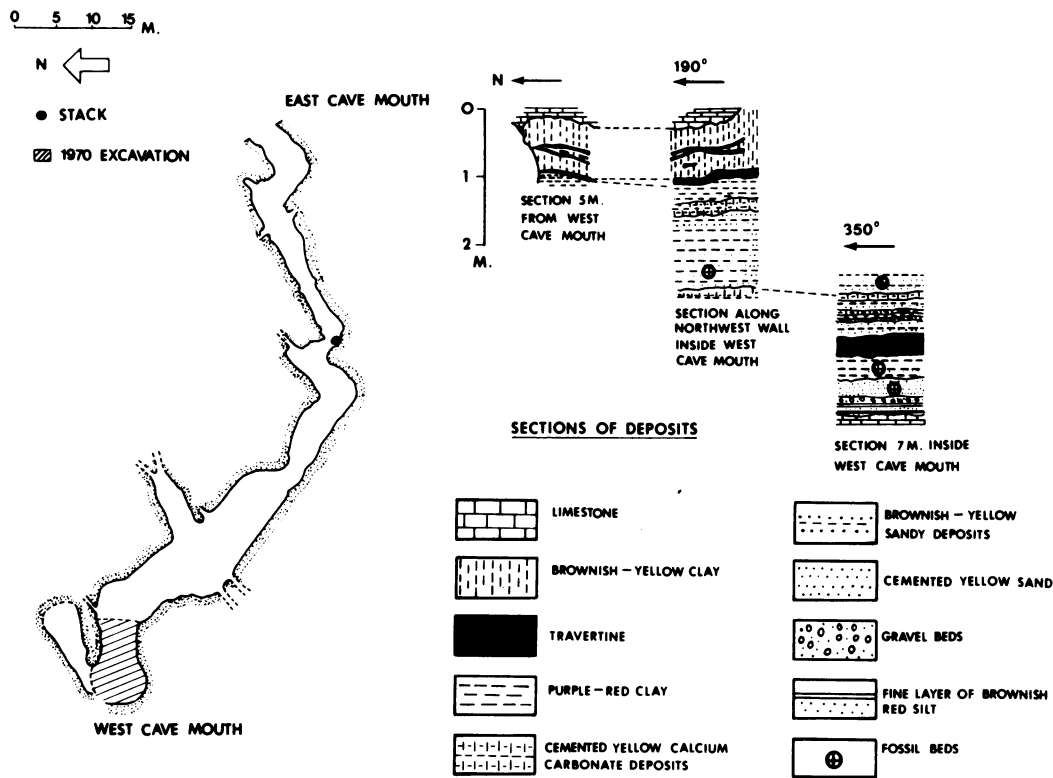Bonvinae
Ovinae
Hystrix sp.

Fig. 4 Horizontal section of Dragon Cave

(From Hsu, et al., 1974)

resented at Xin-She-Chong and equal in size to the genus at Yan-Jing-Gou. The *Ailuropoda* present in the Jian Shi dragon cave is intermediate in size between the small form at Liu Cheng and the larger form at Yan-Jing-Gou. Among the Perissodactyla, the *Equus yunnanensis* (represented by over 50 specimens) is indistinguishable from *E. yunnanensis* from Yuanmou and Xin-She-Chong. The *Tapirus* is intermediate in size between Xin-She-Chong and Yan-Ching-Gou. Among the Artiodactyla, the form referred to *Muntiacus* sp. is possibly conspecific with *Cervulus bohilini* from Zhoukoudian localtiy 18, which is usually considered to be of lower Pleistocene age. The presence of later gomphotheres and saber tooth cats also suggests the placement of Jian Shi in the earliest Pleistocene (Chinese late lower Pleistocene).

Brief Description of the Hominid Molars

Among the four molars referred to *Australopithecus*, one, an unworn right M_1 (PA-507), was not recovered from the dragon bone cave. Gao (1975)[1] reports only that it was recovered from the nearby Badong district. The crown is rectangular in shape with rounded corners and exhibits the so-called protoconidal cingulum (also seen in "Sinanthropus" nos. 52, 98 and 99). Addi-

tionally, the metaconid and protoconid are of approximately equal length (mesiodistal) and both are spearated by a distinct longitudinal occlusal groove. Both are larger than the other cusps and are of approximately equal height. As a result of the situation of the cusps, a +5 pattern is evident in occlusal view (see Figure 5). The central groove extends mesially separating the metaconid and protoconid and communicating with a double anterior fovea. Distally, the longitudinal groove extends between the hypoconid and the entoconid and connects with a posterior fovea situated slightly lingual to the midline of the tooth. The cusps are slightly crenulated and relatively smooth secondary ridges and grooves are present on all five cusps. PA-507 probably represents a germ and no roots are present (summary from Gao 1975 and notes made from Howell's 1975 examination of the specimens in Beijing). PA-504, which has been designated as a right ? M_2, was recovered from the dragon bone cave itself. It is elliptical in shape and also evidences a protoconidal cingulum in the mesio-buccal corner of the tooth. Like PA-507, it is unworn and lacks roots. The occlusal groove system is also developed in a + shape since the distal extent of the protoconid and metaconid are approximately equal.

The metaconid and protoconid are of approximately equal size and height and larger than the other cusps. The entoconid is subdivided by a well-defined groove and a tuberculum sextum is present on the distal border of the molar. The central longitudinal groove extends mesially between the protoconid and metaconid and connects with a Y-shaped anterior fovea. PA-504 is the longest of the molars, but more nearly square than PA-507 (see Tables 4 and 5).

PA-502 and PA-503 (see Figure 6), which were also recovered from the Jian Shi dragon bone cave, have been designated as ? M₂'s. The teeth are probably from the same individual. Both are squarer than the other two molars. A protoconidal cingulum is present on PA-503, but it is very slight. Although the longitudinal groove extends mesially to a wide anterior fovea in PA-502, its distal extension is blocked by a mesio-buccally oriented, "S"-shaped, transverse ridge which connects the entoconid and hypoconid. This feature, which has rarely been observed in hominids, has been observed in a number of specimens from south China assigned to *Pongo*. Howell (personal communication 1975) has suggested that the two molars possibly represent aberrant and/or third lower molars. A tuberculum sextum is also present on both molars. Both molars are worn (especially PA-503) and both possess roots which evidence flatened mesial surfaces. Additionally, both the mesial and distal roots on PA-502 are divided by vertical grooves. The mesial root on both molars is not vertical in relation to the crown but slants in a distal direction.

Comparison of PA-504 and PA-507 Molars

The PA-507 and PA-504 molars are similar to "Sinanthropus" molars in the following respects: the presence of features comparable to a protoconidal cingulum ("Sinanthropus" nos. 44, 98, 99 and 137), sextum ("Sin." nos. 48 and 137), presence of a tuber-

Table 4
Crown Measurements (mm)
(From Gao 1975)

Tooth	M_1		M_2	
Metrical Character	PA-507	PA-504	PA-502	PA-503
Height	(8.6)	9.4	8.7	9.2
Length	14.4	15.3	14.6	15.2
Width	12.2	13.6	14.1	14.0
Length/Breadth index*	84.7	88.9	96.6	92.1
Trigonid width	11.8	13.6	14.0	14.0
Talonid width	12.2	13.3	14.4	13.9
Trigonid index	81.9	88.9	95.9	92.1
Talonid index	84.7	86.9	98.6	91.4

*actually = Breadth/Length × 100

Table 5
A Comparison of Breadth/Length Indices
(From Gao 1975)

Taxon	M_1	M_2
Pongidae	90.0	92.5
Gigantopithecus	89.9	90.6
Australopithecus		
Swartkrans	94.6	92.8
Sterkfontein	91.0	92.2
Homo habilis		
Bed I	Left 85.3	Left 86.5
	Right 86.7	
Bed II	91.3	88.4
"Meganthropus"	90.3	
Sangiran mandible 1939	100.0	101.0
"Sinanthropus"	93.3	96.8
Modern man	93.8-96.8	93.7-97.7
Specimens in this paper	84.7	92.3

Pongid, *Gigantopithecus*, Sinanthropus and modern values from Wu Ju-Kang (1962), Swartkrans and Kromdraai values computed from Robinson (1956), *Homo habilis* values from Tobias and Von Koenigswald (1964)
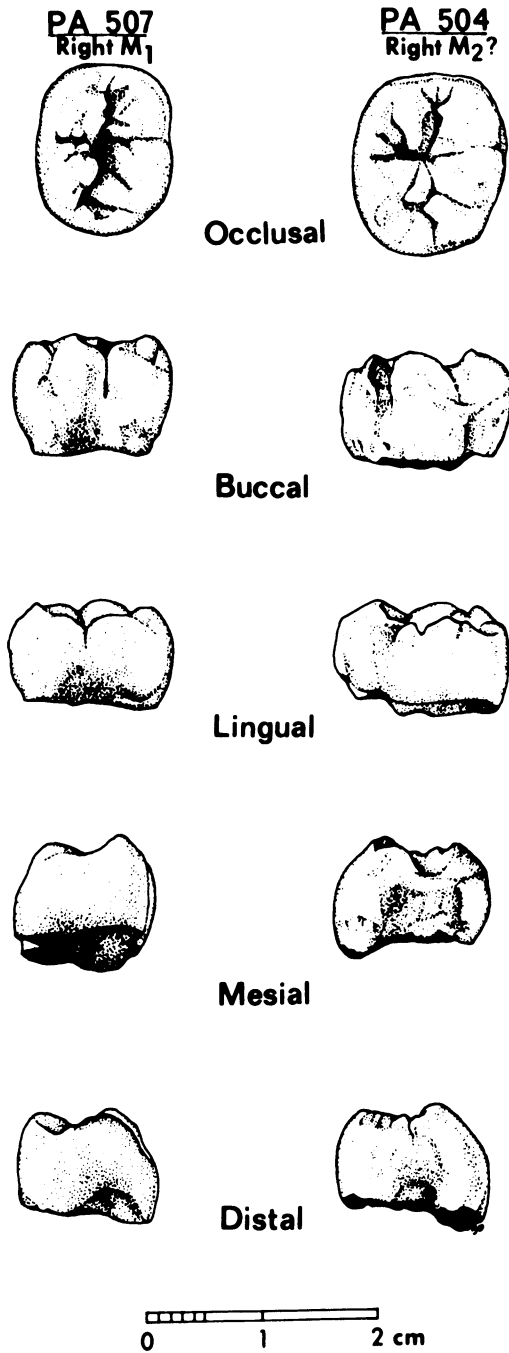
PA 507
Right M₁

PA 504
Right M₂?

Occlusal

Buccal

Lingual

Mesial

Distal

0   1   2 cm

FIG. 5

PA 502
Left M₂?

PA 503
Right M₂?

Occlusal

Buccal

Lingual

Mesial

Distal

0   1   2 cm

FIG. 6

Two hominid lower molars from the Plio-Pleistocene of southern China. PA 507 derives from the Badong District but lacks specific provenience. PA 504 was found in the Jian Shi dragon bone cave discussed in the text. Both specimens have been referred to *Australopithecus* by Gao (1975).
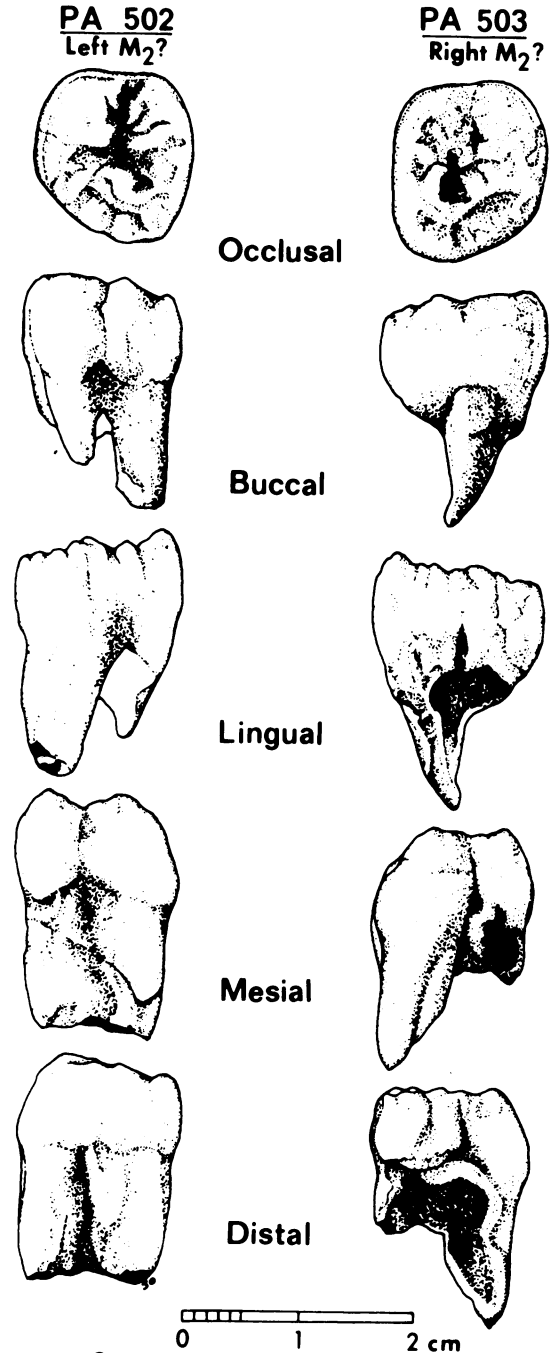
Two hominid lower second molars from the Plio-Pleistocene of southern China. Both derive from the Jian Shi dragon bone cave and have been referred to *Australopithecus* by Gao (1975). These specimens and those figured in Figure 5 were drawn from photographs in Gao (1975) by J. Ogden.

culum sextum ("Sinanthropus" nos. 48 and 107), the presence of a "Y"-shaped anterior fovea ("Sinanthropus" nos. 46 and 99). No. 46 seems particularly similar to PA-504 and, judging only from a photograph, shares the following features: alignment of the protoconid and metaconid, a "Y"-shaped anterior fovea, protoconidal cingulum and the presence of a tuberculum sextum. The "Sinanthropus" molars differ from the Jian Shi molars in evidencing a generally squarer shape and substantially more crenulated cusps. With the exception of the PA-507 width, absolute measurements (see Tables 6 and 7) of the PA-507 and PA-504 molars fall beyond the upper range of both the male and female sample of "Sinanthropus" in length and width. Both are also absolutely larger than the Lantian molars. In shape, the Jian Shi molars (all) are considerably more rectangular than any of the corresponding molars which have been assigned to "Sinanthropus" (see Table 5).

It is unfortunate that the conditions of preservation and wear of the Lantian molars do not allow a detailed comparison with the Jian Shi molars. It is possible however to observe that the Jian Shi molars are absolutely longer than the Lantian molars (14.4-15.3mm vs. 12.6mm for both Lantian M_1 and M_2). In width, the Lantian first and second molars are 11.5mm and 13.0mm, respectively. This is comparable to the 12.2mm and 13.6mm widths of the PA-504 and PA-507 molars. The breadth/length index values are greater in the Lantian molars ($M_1 = 91.3$, $M_2 = 103.6$). It should be noted that the dimensions given for the Lantian molars may be smaller than their true values (Woo 1964). The teeth recovered from Jian Shi (PA-507 and PA-504) also exhibit similarities to presumably lower Pleistocene hominid materials collected from Java. In comparison with the first molar in the Sangiran 8 right mandibular corpus ("Meganthropus" III), the Sangiran 5 mandible (1939 "Pithecanthropus dubius) and the Sangirn 6 mandibular frgment ("Meganthropus" holotype), only the Sangiran 6 M_1 is longer than the M_1 from Jian Shi (Table 6). The breadth/length indices of the Sangiran M_1's are 90.3 for Sangiran 6 and 100 for Sangiran 5 (Sangiran 8 not calculated due to damage). The values of these indices for the first molars are both greater than the value of 84.7 for the Chinese M_1. Both the Jian Shi M_1 and the Sangiran 6 M_1^- evidence a groove-like mesio-buccal cingulum. The Sangiran 8 M_3 (M_1 crown danaged) and

Table 6
Comparison of M_1's (Length and Width)*

	JIAN SHI PA-507 (R)	LANTIAN PA-102 (R)	ZHOUKOUDIAN "Sinanthropus" Range		SANGIRAN			OLDUVAI HOM. 7 (R)	HADAR AL 266-1 (R)	OMO		STERK-FONTEIN RANGE
			MALE	FEMALE	5 (R)	6 (R)	8 (R)	7 (R)	266-1 (R)	W-508 (R)	W-752 (R)	RANGE
Length	14.4	12.6	12.3-14.1	9.9-12.2	13.0	14.8	±12.1	14.3	12.1	13.25	14.1	13.1-15.1
Width	12.2	11.5	11.7-12.8	10.1-11.2	13.0	13.6	±11.4	12.4	12.0	12.2	13.0	11.2-13.9

*Mesio-distal and bucco-lingual in mm
(R) = Right
Sources

Lantian (Woo 1964)
Zhoukoudian (Weidenreich 1937)
Sangiran 5 (Weidenreich 1945)
Sangiran 6 (Weidenreich 1945)
Sangiran 8 (Jacob 1973)

Olduvai (Tobias and von Koenigswald 1964)
Hadar (Johnson and Taieb 1976)
Omo (Howell 1969)
Sterkfontein (Robinson 1956)

Table 7
Comparison of M_2's (Length and Width)*

	JIAN SHI PA-504 (R)	LANTIAN PA-102 (R)	ZHOUKOUDIAN "Sinanthropus" Range		SANGIRAN		OLDUVAI HOM. 7 (R)	HADAR AL 266-1 (R)	STERK-FONTEIN RANGE
			MALE	FEMALE	5 (R)	9 (R)	7 (R)	266-1 (R)	RANGE
Length	15.3	12.6	11.9-13.2 ?	11.3-13.1	14.1	13.4	15.6	13.3	14.4-16.8
Width	13.6	13.0	11.4-13.0 ?	11.1-12.1	14.3	12.5	13.5	14.0	13.2-15.3

*Mesio-distal and bucco-lingual in mm
(R) = Right

Sources
Same as Table 6

the Sangiran 9 M_2^- and M_3 (M_1^- mising also exhibit this feature (Jacob 1976). This feature is present not only in the Jian Shi and Java molars; but also in a number of "Sinanthropus" lower first molars. In contrast to this situation, Weidenreich reports that there is no sign of this cingulum in the Sangiran 5 first mandibular molar (Weidenreich 1945). However, Weidenreich also notes that the buccal cusps are completely worn off in the Sangiran 5 molar. Sangiran 6 displays a more "typical" dryopithecine pattern in the formation of the occlusal groove system and has a correspondingly longer metaconid. ,as is the case in the Sangiran 5 mandible, there is a tuberculum sextum present between the entoconid and the hypoconid.

The second molar of the Sangiran 5 mandible is comparble in a number of respects to the PA-504 molar from Jian Shi. Both molars show a tuberculum sextum and a cingulum on the mesio-buccal corner of the crown. In both specimens the cingulum continues past this groove in a distal direction. In occlusal view, both molars show a + shaped groove system with metaconids and protoconids of subequal length. In overall shape, however, the crowns of the two molars appear to be quite different. The Sangirn second molar is very nearly square with a breadth/length index of 101, while the PA-504 molar is elliptical with an index value of 86.9.

Judging only from photographs, the description of the Jian Shi teeth (Gao 1975) and a cast of the Sangiran 6 mandible, it is also possible to observe certain similarities between the Sangiran first lower molar and the PA-504 molar (which is considered to be a lower second molar). The very linear arrangement of the buccal cusps, the structure of the mesio-buccal cingulum, the development and inclination of the secondary grooves on the distal surface of the metaconid, and the apparent position of the tuberculum sextum exhibit similar morphologies in the two specimens. Additionally, there is a groove delimiting the distal edge of the anterior fovea. Although this area is well worn in the Sangiran 6 molar, it still appears that the anterior fovea is shaped in the form of a broad "Y" as in PA-504. The Sangiran 6 groove may exhibit the type of anterior fovea seen in PA-507. Important differences include the more pronounced swelling of the buccal surface in the Sangiran 6 and the greater definition of the buccal grooves in the PA-504 tooth (perhaps due to the lack of wear). However, in both specimens the groove on the lingual surface is well-defined.

Two measurable M_1's have been reported from the lower Omo basin (Howell 1969). These two specimens, W-405 and W-752, measure in length 13.25mm and 14.1mm respectively. Both of these values are lower than those for all four of the Chinese teeth which range from 14.4mm to 15.3mm. The breadth values of W-508 (12.2mm) and W-752 (13.0mm) are comparable to the Chinese teeth which range from 12.2mm to

14.1mm. Using the method for computing the breadth/length index used in the Gao Jian description, the Omo teeth show higher values (W-508=92.0mm and W-752=92.2mm) than the M_1 from Jian Shi (84.7mm). The W-508 molar is rectangular with rounded corners while the Chinese PA-507 and PA-504 teeth are reported as being rectangular and elliptical respectively. From the photographs, it is obvious that the PA-507 molar has rounded corners like the Omo W-507 molar. The buccal surface of the W-508 molar slopes upward and lingually as do the buccal surfaces of the PA-507 and the PA-504 molars. The two Chinese molars possess a cingulum on the mesio-buccal corner of the crown as does the W-508 molar. In all three teeth, this cingulum extends from the protoconid to the mesio-buccal groove. This cingulum appears to be more developed in the Omo tooth. Both the Chinese teeth and the Omo teeth show somewhat similar occlusal groove patterns. Both show a transverse alignment of the anterior branch of the "Y" and the lingual basal branch of the "Y". The overall occlusal groove pattern, however, seems to be more developed toward a "+" pattern in the Chinese teeth than it is in the Omo teeth. Both the Omo and the Chinese teeth have a subequal and transversely set metaconid and protoconid. An obvious difference between these two teeth is the shape of the anterior fovea which is distinctly "Y" shaped in the PA-504 molar. Judging from a cast and from the photograph included in Howell's description, the anterior fovea is not as well defined in the W-508 molar. The lingual limbs of both the foveae are more developed than the buccal limbs. Additionally, on the Omo molar the anterior fovea is separted from the central fissure by the ridges of the protoconid and the metaconid (trigonid crest). The fovea is also relatively wider. The fovea is not completely separted in the PA-507 and PA-504 molars. The Omo molar, W-508, also appears to show substantially more crenulation of the enamel on the occlusal surface. Although the distal-buccal groove is substantially more developed in the W-508 molar. In spite of these differences, it seems that the Chinese teeth and the Omo teeth are broadly similar in so far as they represent comparable grades of hominid evolution. These similarities are perhaps more interesting when one considers the distances which separate the two sites of recovery.

In the original Chinese description, the PA-507 and PA-504 molars were thought to compare favorbly with Olduvai Bed I and II "Homo habilis" and Austrlopithecine specimens from Sterkfontein. According to the values presented by Gao, the Jian Shi M1 and M2 most resemble Bed I "Homo habilis" and undesignated Sterkfontein specimens. The PA-502 and PA-503 molars are much squarer and comparable in shape to specimens from both Swartkrans and Sterkfontein (Gao 1975). The Chinese paleontologist have pointed out that the cusp size (large protoconid

and metaconid) and morphology (relatively high and acute cusps), the placement of the cusps (buccol-lingual alignment of the distal borders of the pro-toconid and metaconid), the occlusal groove pattern which separates the cusps ("+" shape in PA-507 and PA-504), the presence of a protoconidal cingulum, the presence of a tuberculum sextum, degree of crenu-lation of the cusps and the morphology of the anterior fovea all suggest the similarity between the Chinese molars and the South African australopithecine specimens described by Robinson (1956). On the basis of the degree of development and the morphology of the protoconidal cingulum as well as the alignment of the metaconid and protoconid, Gao emphasizes a specific affinity with *A. africanus*. He has also held that PA-504 is particularly similar to the M_1 preserved in the Taung mandible.

In absolute measurements, the PA-507 and PA-504 molars fall within the range of values obtained for first and second lower molars from Sterkfontein. The val-ues for both Chinese molars are also greater than those obtained for the undescribed A1 266-1 M_1 and M_2 from Hadar which Johanson and Taieb (1976) com-pared with *Homo* (Old. Hom. 7) and KNM-ER 1802. Additionally, the values for the Chinese molars them-selves are very close to those reported for the Old. Hom. 7 mandibular molars from Olduvai. Although the Olduvai type of *Homo "habilis"* is also very close to the breadth/length index values of the Jian Shi molars, the occlusal morphologies of the Olduvai and Jian Shi teeth are not particularly similar.

Conclusions

The foregoing descriptions and comparisons are based only on casts, photographs and published de-scriptions (with the exception of unpublished notes made by Howell during a firsthand examination of the Jian Shi molars). The purpose of this approach is both to provide data normally inaccessible to non-Chinese speaking anthropologists and to indicate the similarity of the Jian Shi molars to specimens which are probably best assigned to early Pleistocene forms of *Homo* (i.e. Sangiran 6, Sangiran 5 and Old. Hom. 7). Additional-ly, the Jian Shi specimens are similar in a number of morphological details to the Omo White Sands speci-mens and specimens recovered from Sterkfontein. The paucity of materials and the known metric and morphological variation which characterizes Plio-Pleistocene Hominidae precludes the assignment of the Jian Shi teeth to a definite taxon. It is, however, important to note that the morphologies exhibited by the Jian Shi molars are quite consistent with the mor-phologies exhibited by other hominid specimens from East and Southeast Asia. The Yuanmou incisors are easily assignable to *Homo erectus* on the basis of the well-known "shovel-shaped" incisors. They are large and robust, but commensurate with the expected

morphology of an early member of the Asian *H. erectus* line represented at Zhoukoudian.

Comparison of the Yuanmou and Jian Shi faunas with the radio-metrically dated Djetis (1.9 = .4 M.Y. BP, Jacob and Curtis 1970) and the Trinil fauna (ca. .83 m.y. BP, Jacob and Curtis 1970) are not particu-larly enlightening. Although many workers have pointed to the similarity between the middle Pleis-tocene or late early Pleistocene Trinil and southern Chinese faunas, it is evident that the vast majority of shared genera were also present in the older Djetis fauna (see Hooijer 1952). Certain "guide fossils" which have been used to indicate the lower Pleistocene in China (i.e. *Equus*, *Ailuropoda*, *Gigantopithecus*) never reached Java. Additionally, some of the supposedly lower Pleistocene Chinese forms which did reach Java such as *Cuon* (= *Megacyon*), small forms of *Tapirus* and machairodont felids are present only in the Djetis faunal zone. Mammalian fossils from both Java and southern China seem to sample a single paleotropical faunal area in which major faunal change during the Pleistocene is not pronounced. With this observation in mind, it is not surprising that the meager sample of hominid specimens from southern China are mor-phologically consistent with penecontemporaneous materials from Java. The similarity to certain African specimens is also interesting considering the distance which separtes the fossil localities. Although the exact affinities of the Chinese material must await further discoveries and the application of absolute dating techniques, it is already apparent that by early Pleis-tocene times the range of hominids extended to the tropical East Asian mainland.

REFERENCES CITED

Colbert, E.H. and Hooijer, D.A. 1953 Pleistocene Mammals from the Limestone Fissures of Szechwan, China. Bull. Am. Mus. Nat. Hist. 102.

Gao Jian 1975 Australopithecine Teeth Associated with *Gigantopithecus*. Vertebrata PalAsiatica 13:81-88. (In Chinese with English abstract).

Hooijer, D.A. 1952 Fossil Mammals and the Plio-Pleistocene Boundary in Java. Proc. Koninkl. Nederl. Adad. v. Wetenschappen, Series B, 55 (4): 463-443.

Howell, F.C. 1969 Hominid Teeth from the White Sands and Brown Sands Localities, Lower Omo Basin (Ethopia). Quternaria XI:47-64.

Hsu Chun-hua, Han Kang-xin, and Wang Ling-hong 1974 Discovery of *Gigantopithecus* Teeth and Associated Fauna in Western Hupei. Vert. Pal. 12:243-309. (In Chinese).

Hu Cheng-chih. 1973 Ape-man Teeth from Yuan-mou, Yunnan. Acta. Geologica Sinica 1:65-71. (In Chinese with English abstract).

Jacob, T. 1973 Palaeoanthropological Discoveries in Indonesia with Special Reference to the Last Two decades. J. Hum. Evol. 2:473-485.

Johanson, D.C. and Taieb, M. 1976 Pilo-Pleistocene Hominid Discoveries in Hadar, Ethopia. Nature 260:293-297.

Kahlke, H.D. 1961 On the Complex of the *Stegodon-Ailuropoda* Fauna of Southern China and the Chronological Position of *Gigantopithecus blacki* v. Koenigswald. Vert. Pal. 2:83-108. (In Chinese with English summary).

Pei Wen-Chung. 19761 Fossil Mammals of Early Pleistocene Age from Yuanmo (Ma-Kai) of Yunnan. Vert. Pal. 5:16-30.

——— 1963 Quaternary Mammals from the Liucheng *Gigantopitehcus* Cave and Other Caves of Kwangsi. Scientia Sinica 12:221-229.

——— 1965 Excavation of Liucheng *Gigantopithecus* Cave and Exploration of Other Caves in Kwangsi. Inst. Vert. Palaeont. and Palaeoanthro., Academia Sinica Mem. 7.

Robinson, J.T. 1956 The Dentition of the Australopithecinae. Transvaal Mus. Mem. no. 9, pp. 1-179.

Tobias, P.V., and G.H.R. von Koenigswald 1964 A Comparison Between the Olduvai Hominines and Those of Java and Some Implications for Hominid Phylogeny. Nature 204:515-518.

Weidenreich, F. 1937 The Dentition of *Sinanthropus pekinensis:* a Comparative Odontography of the Hominids. Palaeontologia Sinica, New Series D, 1.

——— 1945 Giant Early Man from Java and South China. Anthro. Pap. Amer. Mus. Nat. Hist. 40 (1):1-134.

White, T.D. 1975 Geomorphology to Paleoecology: *Gigantopithecus* Reappraised. J. Hum. Evol. 4:219-233.

Woo (Wu) Ju-kang 1964 A Newly Discovered Mandible for the *Sinanthropus* Type-*Sinanthropus lantiensis.* Scientia Sinica 8:801-811.

You Yu-zhu and Qi Guo-qin. 1973 New Materials of Pleistocene Mammals in Yuanmu, Yunnan. Vert. Pal. 11:66-85. (In Chinese).

Zhou (Chou or Chow) Min-chen and Zhang Yu-ping 1974 Chinese Fossil Proboscidea. Peking: Academica Sinica Press, 74 pp. (In Chinese).