ARCHAEOLOGICAL EVIDENCE FOR THE FIRST HUMAN COLONISATION OF EAST ASIA

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ABSTRACT

As one of the most significant events in human evolution and cultural development, Homo erectus *groups spread from the original human cradle, possibly in Africa, to the remainder of the Old World. East Asia is a critical region in understanding this spread because not only is it possessed of a great many human fossils and archaeological records, but it is also situated at the opposite end of the Old World from Africa. In this paper the authors give an account of recent research on early human occupation in China (Fig. 1) and discuss some problems.*

THE LOWER PLEISTOCENE

1. The Yuanmou Basin Sites.

The Yuanmou Basin, a Cenozoic basin in southwestern China, contains Plio-Pleistocene fluvial-lacustrine sediments almost 700m thick with plentiful mammalian fossils. Early geological and palaeontological research between the 1920s and 1940s established the antiquity and richness of the fossiliferous beds and established them as standards for Lower Pleistocene strata and fauna in southern China (Bien 1940; Colbert 1940). Hominid fossils and stone artifacts were found at Yuanmou in 1965 and afterwards.

Up to now the Yuanmou hominid is represented only by two upper central incisors from a single individual. Some researchers proposed a new subspecies, *Homo erectus yuanmouensis,* for the Yuanmou specimens (Hu 1973), but others have regarded them as from the same subspecies as the Zhoukoudian remains and other *Homo erectus* fossils found in China (Wu and Dong 1985). A total of 22 stone artifacts has been found at Yuanmou, including 12 pieces from excavation. In addition, 12 stone artifacts have been reported from four other localities nearby, claimed to belong to the same period as the Yuanmou man site (Wen 1978; Huang *et al.* 1985; Zhou 1991). The artifacts are made of quartz and quartzite and have small dimensions (generally smaller than 60 mm). They consist of unmodified flakes, cores and tools retouched by primary direct percussion, including side scrapers. It is necessary to emphasize that the stone artifacts of Yuanmou are not questionable, as some workers have thought (Schick and Dong 1993), but many of them have been discovered *in situ* during excavation and have clear records (Yuan *et al.* 1978).

Initial palaeomagnetic study indicated an early age for Yuanmou within the Gilsa Subchron of 1.7 Ma (Li *et al.* 1977) and 1.63-1.64 mya (Cheng *et al.* 1978a). This result has since been the subject of much controversy. Some have suggested a Middle Pleistocene age of only 0.5-0.6 mya, during the early Brunhes Chron (Liu and Ding 1983). However, recent research in lithostratigraphy, biostratigraphy, magnetic stratigraphy, heavy minerals, lithofacies and palaeogeography has supported the earlier age (Zhang *et al.* 1994).

2. The Fen-Wei Graben Sites.

The Lantian Basin is part of the Fen-Wei Graben, which consists of the valleys of the Fen and Wei rivers, two main tributaries of the Yellow river within the loess plateau of northern China. Fossiliferous sediments, about 1300 m thick of Tertiary and more than 400 m thick of Quaternary deposits, occur in the basin. Following the finding of a hominid mandible in the Chenjiawo site in 1963, a hominid cranium was unearthed at Gongwangling, the main "Lantian man site", during the 1964 ex-

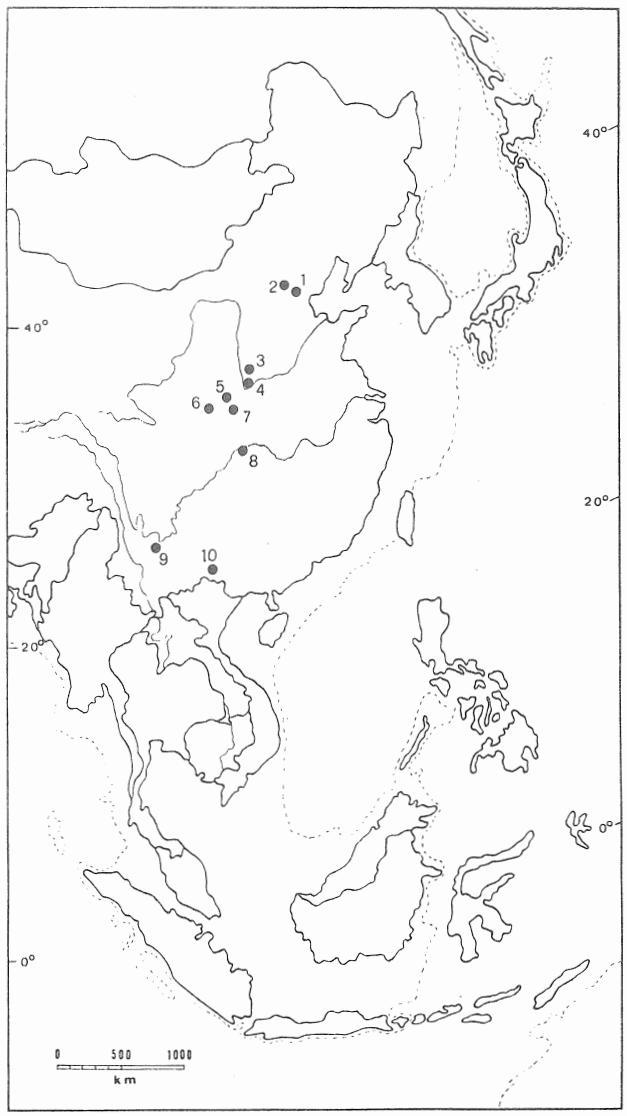

Figure 1: Major sites with hominid fossils and stone artifacts of Lower and Middle Pleistocene date in China.
1. Zhoukoudian; 2. Nihewan; 3. Dingcun; 4. Xihoudu; 5. Lantian; 6. Hanzhong; 7. Quyuanhekou; 8. Longgupo; 9. Yuanmou; 10. Bose

cavation. The Chenjiawo mandible, representing an old female, is similar in many respects to the mandibles of Zhoukoudian *Homo erectus* (Wu and Dong 1985). Palaeomagnetic studies suggest the age of Chenjiawo may be 0.65 mya (Ma *et al.* 1978; An and Ho 1989) or 0.5 mya (Cheng *et al.* 1978b). The Gongwangling cranium, which represents a female individual over 30 years of age at death, is more primitive than the *Homo erectus* fossils from both Zhoukoudian and the Kabuh Formation of Sangiran in Java (Wu and Dong 1985). Initial palaeomagnetic research provided an age for it of 0.75-0.8 mya (Ma *et al.* 1978) or 1 mya (Cheng *et al.* 1978b). Recently, dating based on new palaeomagnetic polarity determinations and on the lithostratigraphic position of the fossils in the loess-palaeosol sequence has indicated an earlier age of 1.15 mya (An and Ho 1989).

A total of 31 stone artifacts of quartz and quartzite was unearthed from the deposits from a level slightly higher than that of the hominid cranium during the 1965-66 excavations and the 1975 survey (Wu *et al.* 1966; Da and Xu 1973; Wei 1977). They consist of scrapers, flakes and cores. A handaxe was found *in situ* in a palaeosol outcrop about 2 km east of Gongwangling, which may be older than the hominid cranium. This handaxe, retouched bifacially from a heavy quartz flake showing Acheulian affinity, may be the oldest handaxe reported from East Asia (Figure 2).

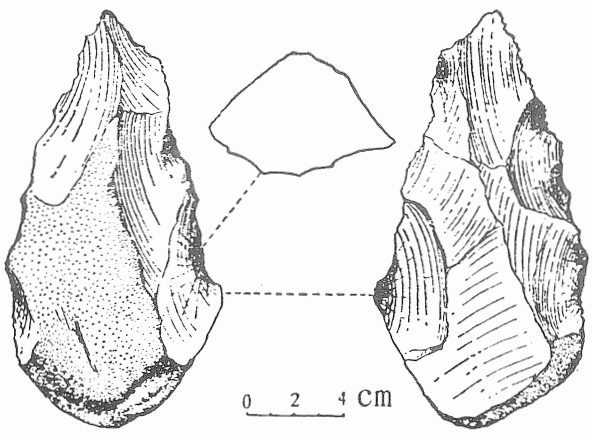

Figure 2: A handaxe from Lantian, reprinted with permission from Da and Xu 1973.

The Xihoudu site is also located in the Fen-Wei Graben. 32 controversial stone artifacts, a broken deer horn and some fragments of burnt bone were discovered in a one meter thick layer of cross-bedded sands and gravel in the 170 m terrace of the middle Yellow river valley, associated with an unquestionably Lower Pleistocene fauna (Jia and Wang 1978). An unpublished palaeomagnetic analysis has given an age of 1.8 mya for the site (Jia 1985). The problem is that the stone materials from this site are of uncertain human manufacture, although it is difficult to accept that the broken deer horn with a V-shaped cut mark is entirely the result of natural causes.

3. The Nihewan Basin Sites.

The Nihewan Basin was the scene of discovery of very rich deposits of Plio-Pleistocene mammalian fossils in the 1920s (Barbour *et al.* 1927; Teilhard de Chardin and Piveteau 1930). Following the discovery during the past three decades of a large number of archaeological sites spanning the Lower through Middle to Late Pleistocene and Holocene, the Nihewan Basin has become recognized as one of the key regions for understanding early hominid evolution in Asia.

Among the Nihewan sites, Xiaochangliang, Donggutuo and Banshan have the earliest traces of human occupation. Thousands of stone artifacts in association with a Lower Pleistocene fauna have been excavated from fluvial and lacustrine deposits (You *et al.* 1978; Wei 1985 and 1994; Huang 1985; Jia and Wei 1987; Schick *et al.* 1991; Keates 1994). The majority are of fine and coarse grained chert and basalt. Quartz, quartzite and sandstone were substantially less frequently utilized. All of these raw materials were selected from the local bedrock in the vicinity of the sites. Direct free-hand percussion with a low frequency of bipolar flaking was used. The assemblage consists of flakes, cores and tools which include categories such as side scrapers, end scrapers, denticulates, notches, borers, small choppers and utilized flakes, as well as a few non-normal burins and proto-carinated scrapers (Figure 3). Most tools are small and retouch was done by simple direct percussion. The working edges on most implements are rather zigzag in plan, but a few have neat working edges which might have been retouched on an anvil (Huang 1985). According to palaeomagnetic studies the layers yielding stone artifacts at both Xiaochangliang and Donggutuo lie below the Jaramillo Subchron (c. 0.93-0.97 mya) (You *et al.* 1978; Li and Wang 1982; Schick and Dong 1993). The Upper Banshan deposit can be compared with that at Donggutuo in stratigraphic context (Wei 1994). It is very interesting that the cultural layers at Xiaochangliang and those of Lower Banshan lie more than 20 m below that of Donggutuo, indicating a greater antiquity. Recent palaeomagnetic research at Xiaochangliang suggests that it may extend back to 1.67 mya (Tang *et al.* 1995).

4. Longgupo Cave Site.

Longgupo cave site ("Wushan Hominid site") is located in Wushan county in Sichuan province. It lies on the western edge of a karst depression about 20 km south of the Yangtze River and has an elevation of 830 m above sea level. Four years of excavations (1985-88) undertaken by IVPP and the Museum of Natural History in Chongqing City (Sichuan province) yielded exciting descoveries of very archaic hominid fossils and stone discoveries of very archaic hominid fossils and stone artifacts. The associated fauna consists of 92 species of mammals, including *Gigantopithecus* and *Ailuropoda microta* (pygmy giant panda), which suggest that the hominid and stone artifact bearing levels date to the earliest Pleistocene. Palaeomagnetic analysis indicates an antiquity of 2.01 to 2.04 mya BP for the same levels (Huang, Fang *et al.* 1991). In 1992, joint Chinese-American-Canadian geochronological research corroborated the age by using ESR analysis (Huang, Ciochon *et al.* 1995)

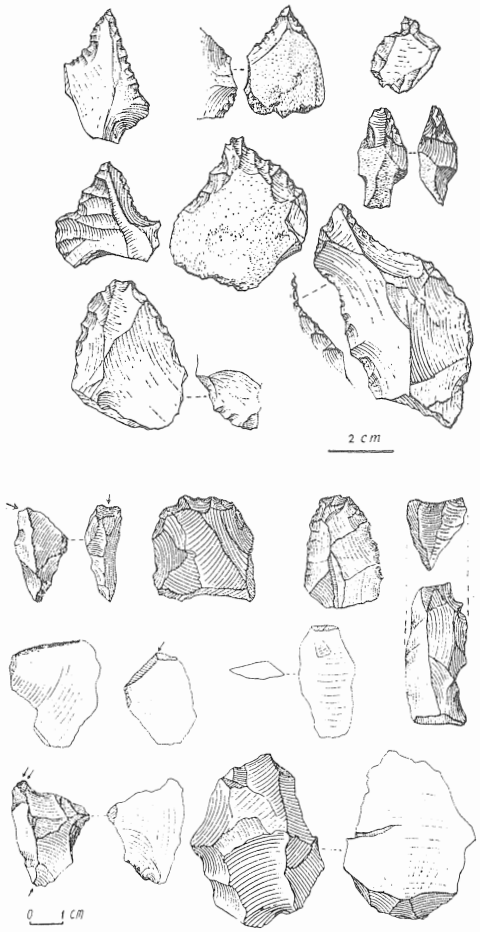

Figure 3: Stone artifacts from Donggutuo (top) and Xiaochangliang (bottom), reprinted with permission from Wei 1985 and Huang 1985.

The "Wushan Hominid" is represented by a left mandible fragment (with P_4, M_1 and M_2 alveolus) and a right upper lateral incisor. Preliminary observation in 1991 attributed these materials to a subspecies of *Homo*

erectus. However, the further study in 1995 claims that the Longgupo dentition is comparable in age and morphology to that of early representives of the genus *Homo* (*H. habilis* and *H. ergaster*) in East Africa, and is demonstrably more primitive than that seen in Asian *Homo erectus*. Only two stone artifacts were unearthed from the site, one being an elongated, spherical cobble classified as a hammer, the other a lenticular flake classified as a chopper (Figure 4).

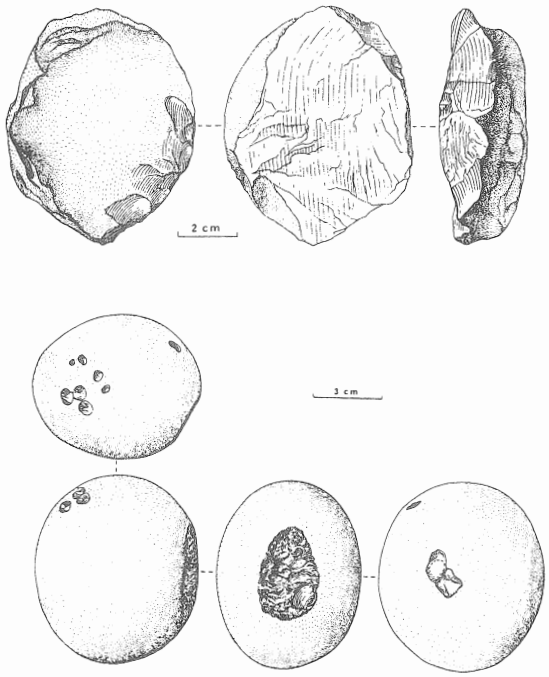

Figure 4: Chopper and hammerstone from Longgupo, reprinted with permission from Huang, Fang et al. *1991.*

Many researchers remain sceptical of the Longgupo discovery, especially concerning the hominid fossils and stone artifacts, as well as early dates (Culotta 1995). We think these questions must be resolved by new materials and further research in the future. However, Longgupo remains a very important discovery.

THE MIDDLE PLEISTOCENE

1. The Zhoukoudian Sites

Zhoukoudian is located at the junction of the eastern plains and western mountains, approximately 50 km southwest of Beijing. More than 20 localities yielding vertebrate fossils, human fossils and archaeological materials have been discovered in cave or fissure formations in the limestone terrain since the early part of this century. Locality 1 (the "Peking Man" site) is the most famous, and has yielded abundant hominid fossils attributed to *Homo erectus* (*Sinanthropus pekinensis*). Thirteen fossiliferous layers in this site consist mainly of breccia, as well as ash and sand, totalling about 50 m in thickness. Animal fossils include almost 100 species of mammals and more than 60 species of birds. Extremely rich cultural remains include stone artifacts, bone artifacts and traces of fire in the form of ash, charcoal, burnt bone and burnt stone. These materials, in association with the hominid fossils, provide significant evidence for understanding the biology and behaviour of the *Homo erectus* population (Black *et al.* 1933; Jia and Huang 1990).

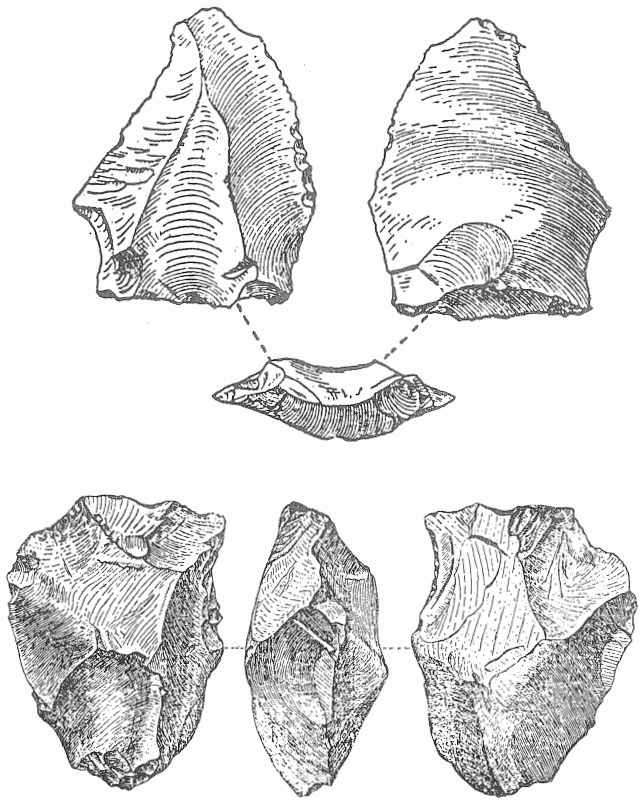

Figure 5: Flake 6.8 cm long from Zhoukoudian Locality 15 and chert implement 7.8 cm long from Locality 13, reprinted with permission from Pei 1939 and Pei 1934.

The Zhoukoudian stone assemblage consists of more than 100,000 specimens from Locality 1. Local vein quartz accounts for more than 90% of these, with low proportions of sandstone, chert, crystal quartz and other rocks. Due to the poor quality of the quartz the majority of the material consists of debitage, but there are also flakes, cores and tools (Figure 5). The Zhoukoudian assemblage is characterized by the use of small, irregular

flakes for implements such as side scrapers, end scrapers, notches, borers, burins and denticulates. Heavy duty tools made of large flakes or cobbles and classified as choppers and spheroids only comprise a fraction of the total tool kit. Bipolar flaking, free-hand direct percussion and block-on-block techniques were used in flaking and retouching, with the bipolar technique being common (Teihard de Chardin and Pei 1932; Pei and Zhang 1985).

In the early research at Zhoukoudian, based mainly on biostratigraphy and faunal correlations, the date of Locality 1 was concluded to be Middle Pleistocene. Since the end of the 1970s, isotope methods including fission track dating, uranium series dating, thermoluminescence, amino acid racemisation, ESR and palaeomagnetism have all been used for dating purposes. Although these procedures have produced different results, in combination they seem to indicate a time range of c. 0.6 to 0.2 mya BP from layer 11 to layers 1-3 in Locality 1 (after Wu *et al.* 1985).

Within the Zhoukoudian area, Localities 3, 4, 13, 15 and 22 also can be attributed to human occupation in the Middle Pleistocene. Locality 13 was thought to provide evidence for the earliest known human occupation in China by early workers (Pei 1934). However, further research on bio- and lithostratigraphy suggests that it corresponds to the lower part of Locality 1 (Pei and Zhang 1985). Evidence for the use of fire, plus a few stone artifacts including a bifacial core-tool made of chert and several quartz flakes were found in Locality 13, associated with mammalian fossils.

Localities 3, 4, 15 and 22 can be attributed to the late Middle Pleistocene and correspond to the upper part of Locality 1 based on biostratigraphy. Locality 15 is the most important one because of its large stone assemblage, which showed interesting feaures in technology and typology (Pei 1939), including an appearance of cleavers.

2. Fen-Wei Graben sites

The Fen and Wei valleys were densely populated during the Middle Pleistocene. Several sites have been known since the 1950s, of which Dingcun, Kehe and Sanmenxia are the major ones. Near Dingcun, a total of 26 localities yielding stone artifacts has been discovered within a 11 km long area of the Fen river valley. The sites are situated on Fen terraces 2, 3 and 4, with 2 being the youngest. Sixteen localities on terrace 3 have yielded more than 3000 stone artifacts belonging to the Dingcun industry. These are predominantly made on a fine-grained black hornfels, a kind of metamorphic rock that outcrops in the adjacent mountains 10 km to the west of Dingcun but which could perhaps also be obtained from the river gravels during Palaeolithic times without difficulty. Other raw materials such as limestone and sandstone were used for tool manufacture, but only in low proportions (Pei *et al.* 1958).

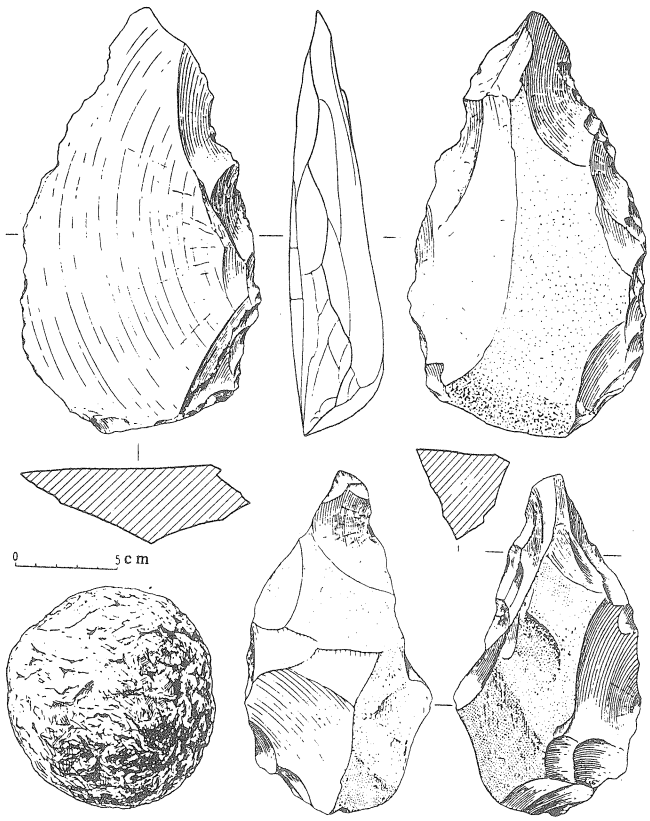

Figure 6: Stone artifacts from Dingcun, reprinted with permission from Wang et al. *1994.*

Questions of technological tradition and date are two areas of controversy which surround the Dingcun industry. Some scholars date it to the early Upper Pleistocene, as an example of a "chopper-chopping tool" industry (Movius 1956; Pei *et al.* 1958; Pei 1965; Wang *et al.* 1994). Others, including Jia (1956), Henri Breuil (after Pei 1965), Freeman (1977) and the senior author of the present paper (1987 and 1989) point to many Acheulean forms, such as handaxes, cleavers and picks, as being present (Figure 6). Such features suggest a late Acheulean date within the late Middle Pleistocene (Jia 1955; Liu and Ding 1984). Dating research on the Dingcun industry has yielded conflicting and controversial results, for example 70 kya (amino acid), 75-104 kya (ESR), 120 kya (palaeomagnetism) and 160-210 kya (uranium series) (after Wang *et al.* 1994). The present

authors believe that placing the Dingcun industry in the late Middle Pleistocene is most reasonable in view of the physiographic and lithologic characters of the strata and the characteristics of industrial technology and typology.

Apart from the localities on Fen valley terrace 3 there are four localities on terrace 4 also claimed to date to the late Middle Pleistocene, and one locality on terrace 2 that can be attributed to the late Upper Pleistocene (Wang *et al.* 1994). The stone assemblages from terrace 4 are in no essential way different from those from terrace 3 in technology or typology. The assemblage from terrace 2 is composed of two components: heavy-duty tools in the Dingcun tradition, and microliths.

3. The Bose Sites

Bose (Baise) is one of several Cenozoic basins in southern China. It covers an area of roughly 800 sq. km and lies at an elevation of 80 to 100 m above sea level. The Youjiang river, one of the smaller tributaries of the Zhujiang (Pearl) river, flows eastward through the basin. The basic sediment in the basin consists of 3000 m of lacustrine formations, overlapped by lateritized fans which consist of c. 15 m of basal gravel overlain by 15 m of mottled brick-red sandy clay and clay. These fans have been downcut by the river and contain terraces at 50 to 100 m above the river level. The first archaeological site in the basin was found in 1973 (Li and You 1975). To date, almost one hundred sites are now known and more than 6000 stone artifacts have been collected. However, almost all came from the surface of the eroded laterite and their original context was not clear until excavation produced a total of c. 600 stone artifacts in the laterite bed in two sites during excavations in 1988-89 and 1993. Tektites were also found *in situ* in association with stone artifacts in 1993, and fission track dating of these gives an age of 0.732±0.039 mya for the Bose sites (Guo *et al.*, in press).

The lithic raw materials consist of quartzite, quartz, quartzitic sandstone, conglomerate and siliceous rocks. The tools are made mainly on cobbles, with some on heavy flakes. Most exceed 10 cm in dimension. Picks, choppers, handaxes, heavy scrapers and hammerstones are all major categories, with picks being the most common (Figure 7). More than 100 handaxes have been found, this being the largest number from any single Palaeolithic locality in China. Hard hammer percussion was commonly used in manufacturing and most tools are unifacially retouched, with jagged edges. The presence of a soft hammer technique is uncertain and bifacial flaking is rare, but a few handaxes and picks have possible Acheulean affinities.

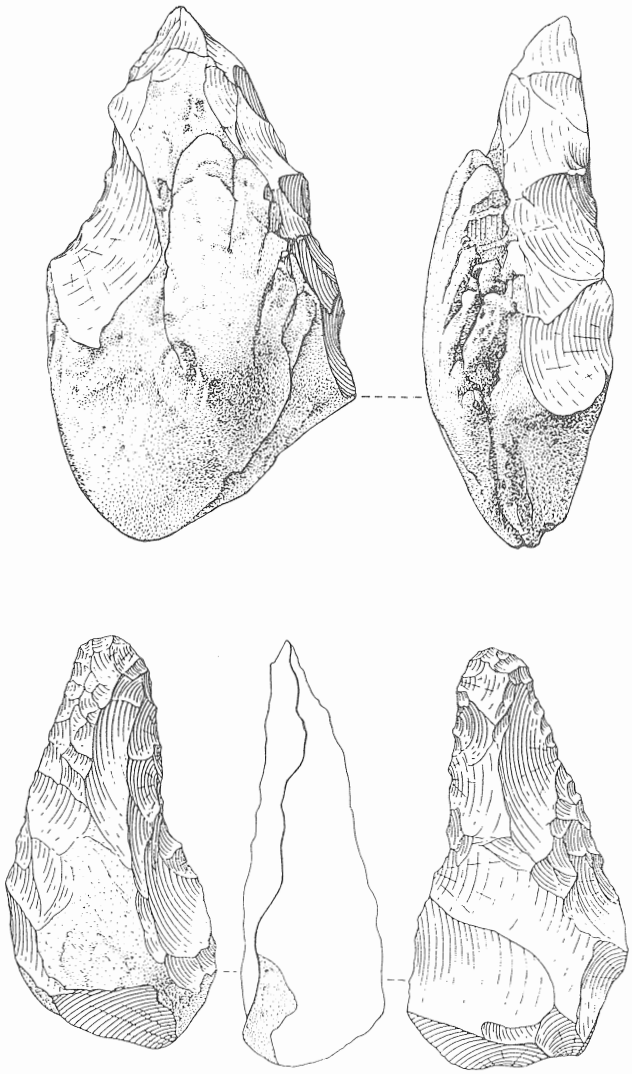

Figure 7: Pick 18cm long (top) and handaxe 11 cm long from Bose

4. The Hanzhong Sites and the Quyuanhekou Site

The oldest known human occupation in northern South China comes from the upper reaches of the Hanshui river, the longest tributary of the Yangtze. The Hanzhong sites in Shaanxi province and the Quyuanhekou site in Hubei represent this occupation. The Hanzhong basin is a large Cenozoic basin in which a series of Hanshui river terraces have been cut into Tertiary fluvial and lacustrine formations. A stone assemblage characterized by heavy pebble tools has been reported from the 40-50 m terrace in association with the Middle Pleistocene *Stegodon-Ailuropoda* fauna. Up to now, more than 2000 stone arti-

facts have been collected from surface contexts and from within the terrace. Locally-occurring quartz, quartzite and volcanic rocks were frequently utilized. The tools consist of picks, choppers, spheroids and a few handaxes, cleavers and heavy scrapers. Most are made on cobbles and fashioned by a hard hammer technique. The Hanzhong stone assemblage can be compared closely with the Bose industry in technology, typology and chronology (Huang and Qi 1987; Huang 1991 and 1992).

The Quyuanhekou site is situated in the lower reaches of the Hanzhong basin, in the same geomorphological situation as the above sites. A few pebble tools similar to those of the Hanzhong assemblage were found in association with abundant mammalian fossils attributed to the *Stegodon-Ailuropoda* fauna. Two relatively complete hominid crania (the Yunxian skulls) attributed to *Homo erectus* were excavated from the terrace deposits in 1989 and 1990. It has been claimed that the Yunxian remains resemble those of Lantian rather than Zhoukoudian (Etler and Li 1994).

Pebble tool assemblages similar to those from Hanzhong are also reported from many other tributaries of the middle and lower Yangtze, from the provinces of Hunan, Hubei, Jiangxi and Anhui (Huang 1991).

5. Qianxi Guanyindong and Panxian Dadong

Qianxi Guanyindong and Panxian Dadong are two cave sites located on the Yunnan-Guizhou Plateau. Qianxi Guanyindong was initially explored in 1964 and in the following years, and produced c. 3000 stone artifacts in association with a Pleistocene *Ailuropoda-Stegodon* fauna consisting of 23 species of mammals. The workers subdivided the fossiliferous deposits within the cave into two groups; Group A being the upper and Group B being the lower. The majority of the stone artifacts and fossils came from Group B and were thought to date to the early Middle Pleistocene. The Group A deposits are younger, but still considered Middle Pleistocene (Li and Wen 1986; Li 1989). However, the uranium dates run by two laboratories show a younger age, with Group A being dated to 57±3 kya and < 40 kya, and Group B being dated to 76-119 kya and 10-19 kya (Yuan *et al.* 1986; Shen and Jin 1992).

The stone assemblage from Guanyindong is made on black and grey chert and related cryptocrystalline siliceous rocks. Sandstone, quartz and a variety of local igneous rocks were also occasionally used. Simple direct percussion with a hard hammer was the principal means of reducing cores and retouching tools. Side scrapers are the most common tools, comprising 82.28% of the collection. Other categories include end scrapers, notches, points, borers, burins, handaxes and choppers.The Guanyindong industry is characterized by relatively small light-duty tools (Figure 8).

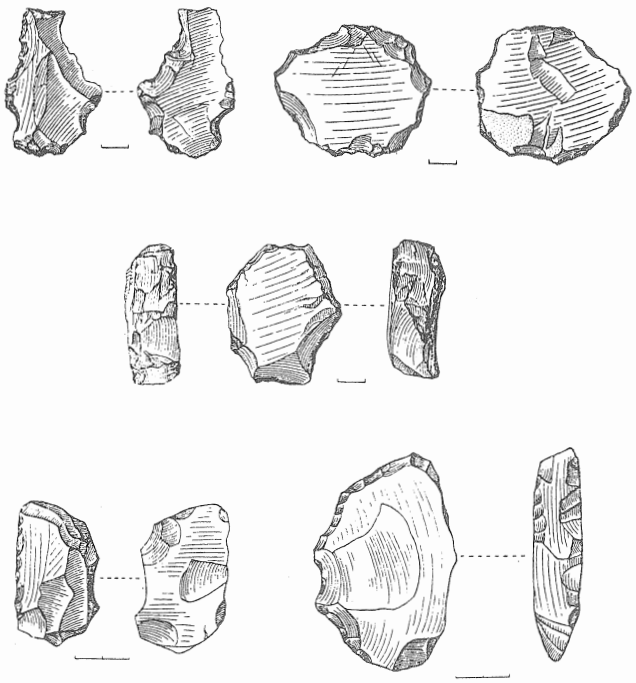

Figure 8: Stone artifacts from Guanyindong (scale bars each 1 cm long), reprinted with permission from Li and Wen 1986.

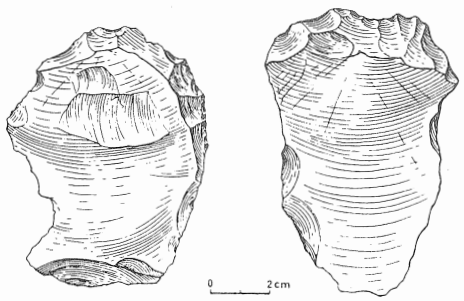

Figure 9: Flakes with multifacetted platforms from Panxian Dadong, reprinted with permission from Si et al. *1993.*

Panxian Dadong is a recently discovered cave site (Si *et al.* 1993; Huang *et al.* 1995). As its name (Grand Cave) implies, Dadong is a massive cavern. The main hall measures 220 m from back wall to mouth and covers an area of roughly 8000 sq. m. Natural features inside the cave include two large stalagmites and one immense stalacto-stalagmite with a diameter of approximately 20 m. These formations overlie archaeological layers and can be used for some general age determinations. Sam-

ples taken from the stalacto-stalagmite for preliminary radiometric (uranium series) dating provide a minimum age of 300 kya for a portion of the cultural sequence. The sediments inside the cave consist of brownish-yellow clays, sandy travertines, breccias and large limestone blocks dislodged from the cave roof. The presence of well-bedded sandy travertines that develop during moist, mild climatic regimes suggests a sequence of environmental changes during the occupation and formation of the site. While the full depth of the deposit within the central portion of the cave has yet to be determined, the depth near the cave entrance is estimated to be 19.5 m.

The first two seasons of excavation in 1992 and 1993 yielded bones of over 40 species of mammalian fossils, more than 2000 stone atifacts, evidence for the use of fire (charcoal, burnt bone and ash) and one fragmentary hominid tooth. The fauna recovered from Dadong is representative of the Pleistocene *Ailuropoda-Stegodon* faunal suite of southern East Asia. The faunal remains consist of fragmentary limb shafts, mandibles, horns and individual teeth. Their condition suggests that both hominid and carnivore activities took place in the cave. The hominid tooth is a lingual surface fragment from a worn adult maxillary central incisor. It exhibits some shovelling and a large lingual tubercle with finger-like projections. The stone assemblage is made mainly on chert and basalt and includes side scrapers, end scrapers, notches, borers, denticulate tools, choppers, hammerstones, anvils, a few burins and a small handaxe. A number of small exhausted chert cores show secondary usage as scrapers. The borers and notches vary widely in size. The technology is primarily hard-hammer direct percussion. A noteworthy feature of the assemblage is the presence of a prepared core technique for flake production, this being the most extensive reported evidence for this technique in the Palaeolithic of southern China (Figure 9).

SUMMARY

In East Asia the localities which have yielded fossils of *Homo erectus* are concentrated in the eastern part of mainland China. They include Zhoukoudian, Lantian (Gongwanling and Chenjiawo), Yuanmou, Hexian, Yunxian (Quyuanhekou), Nanjing and possibly Longgupo. The hominid fossils mentioned above have all been found in association with Pleistocene mammalian faunas and mostly in association with stone assemblages. Since the 1970s, various absolute dating methods have been applied to these sites. For example, *Homo erectus* at Zhoukoudian has been dated to between 0.6 and 0.2 mya, and Gongwangling to c. 1.15 mya.

Compared with hominid fossils, the stone assemblages of the Lower Palaeolithic are abundant and extend into the Korean peninsula and Japan. They can be subdivided to two chronological periods. At least seven sites, including Longgupo, Yuanmou, Lantian (Gongwangling), Xihoudu, Xiaochangliang, Donggutuo and Banshan can be attributed with varying degrees of certainty to the Lower Pleistocene. Suggested ages range from 1 to 2 mya, based on palaeomagnetic studies. The pebble tool industries from the laterite beds which occur widely in many drainage basins offer significant evidence for human occupation during the Middle Pleistocene. Among them, the Bose industry has been documented to extend back to 0.7 mya based on radiometric dating.

The tools of the Lower Palaeolithic of East Asia consist of both heavy duty tools and light duty tools, similar to those of East Africa. Technologically and typologically, there are many similarities between the stone tools of the two regions. It seems to us that the Lower Palaeolithic from these two regions may reveal evidence for the first great migration of humans from East Africa into East Asia.

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