Paleolithic Cultures in China

Uniqueness and Divergence

by Xing Gao

This paper presents an overview of the Chinese Paleolithic industries between 300 ka and 40 ka, a time span now termed the "later Early Paleolithic" (LEP) in the Chinese chronological scheme. It describes the unique features of LEP remains in China compared with contemporaneous materials in Africa and western Eurasia as well as the internal diversity and complexity of these Chinese Paleolithic assemblages. Basic features of LEP remains in China include the persistent and conservative pebble-tool and simple flake-tool traditions, the use of poor-quality local raw materials, tool fabrication on pebbles and direct use of unretouched flakes, opportunistic flaking, simple and casual modification, and the lack of obvious temporal trends. The diversity and complexity of Chinese Paleolithic cultures as they are expressed in terms of the major difference between southern China's pebble-tool tradition and northern China's simple flake-tool tradition are also assessed. Based on such generalizations and analyses, a comprehensive behavioral model is proposed to explain the unique features of LEP cultures in China and the alternative pathway of human evolution and adaptation in China during that period of time.

Introduction

Recent research and discussions concerning Pleistocene human technological development and adaptive strategies have largely concentrated on archaeological materials during the Middle Late Stone Age and the Middle Upper Paleolithic transitions in Africa and western Eurasia, where scenarios of early modern human origins, dispersal, and their replacement of the Neanderthals are believed to have taken place. In this wave of heated discussions and debates, China and East Asia keep almost silent. While the Out of Africa theory enjoys overwhelming support, the Continuity with Hybridization theory looks odd and outmoded, and the cultural remains of *Homo erectus* and archaic *Homo sapiens* seem irrelevant and negligible, for they might be outside the lineage leading directly to living humans. Once again, as with the influential Movius Line hypothesis that prevailed in the mid-twentieth century (Movius 1944, 1948), Paleolithic cultures in China are found deep in a "backwater."

Human evolution toward complexity and modernity might have taken different pathways in different regions. In this regard, Asia has received far less attention than Africa and Europe in the search for human origins, but it is no longer considered to be of marginal importance. Indeed, a global perspective on human origins cannot be properly understood without a detailed consideration of the largest continent (Dennell 2009). While studies on African Middle Stone Age and western Eurasian Middle Paleolithic industries may produce insights about the emergence of modern human behavior, technology, and the relationship/possible interaction between the intruding early modern human groups and the Neanderthals, research on contemporary East Asian Paleolithic remains may provide us a comparative data set of cultural and behavioral variability for ancient human groups living in different environmental and ecological zones, and this may encourage us to look at the third lineage of human evolution in late Middle Pleistocene. The unique feature and "conservative" progression of eastern Asian Paleolithic industries in general and their obvious distinction from the West seems to support the scenario of continuous evolution and development of local populations, which may present a major challenge to the Out of Africa or Total Replacement hypothesis (Gao et al. 2010).

In order to provide relevant information for this workshop, titled "Alternative Pathways to Complexity: Evolutionary Trajectories in the Middle Paleolithic and Middle Stone Age," descriptions of the Chinese Paleolithic remains and discussions of related questions of this paper will focus mainly on the time period between 300 ka and 40 ka, a cultural stage previously described as the later part of the Lower Paleolithic and the whole Middle Paleolithic, now reclassified as the later Early Paleolithic (LEP) by me and my colleagues (Gao 2000; Gao and Norton 2002).

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Research Tradition and Conception concerning the Chinese Early Paleolithic

The practice of Paleolithic research in China still to a certain extent differs from that of the West, including terminology, the classification-typology system, and the way data are presented and interpreted. Therefore, a brief introduction to the research tradition and its conception may help Western scholars understand the content of this paper and research accomplishments in this field in China.

A Shift from the Middle Paleolithic to the LEP in Chinese Paleolithic Research

Paleolithic archaeology in China was an adopted enterprise from the West in the 1920s and 1930s, and the three-stage Paleolithic cultural model was carried along with the Western scientists who came to China to initiate this field and train local scholars. Accordingly, the Chinese method copied the Western model that was based on artifactual material indigenous to western Eurasia, and the use of similar developmental stages implies that the cultural evolutionary trajectory in China was similar to Africa and western Eurasia. However, this practice ran into problems when it became obvious that in fact few similarities appear to exist between the Chinese materials and those of the West (Gao and Olsen 1997; Ikawa-Smith 1978; Movius 1944) and that the Western "index" stone-tool types of different cultural stages are quite scarce in China and East Asia. Consequently, the derived Paleolithic cultural development periodization in China began to take a different approach. Two criteria have been utilized for defining a distinct Middle Paleolithic in China: (1) age of site (i.e., all archaeological materials dating from the late Middle–Early Upper Pleistocene—ca. 200–40 ka—were considered Middle Paleolithic); and (2) association with archaic *Homo sapiens* remains.

Gradually, as the weakness of defining cultural stages based on chronometric information and association with certain kinds of human fossils became obvious, researchers began to agree that such a practice must be based exclusively on the archaeological record (Gao 1999). An analysis of four stone-tool criteria (raw material procurement, core reduction, retouch, and typology) to determine whether a distinct Middle Paleolithic existed in the Chinese record indicates that very little or very gradual change occurred in lithic technology and typology between the Lower and Middle Paleolithic. Accordingly, there is little reason to retain the three-stage model of cultural sequence. Instead, a two-stage progression is proposed consisting of the Early and the Late Paleolithic. The transition between these two cultural periods occurred with the development of more refined lithic techniques (e.g., blade and microblade technology) and the presence of ornaments, art, and/or symbolism, indicators of modern human behavior (ca. 35–30 ka; Gao and Norton 2002).

Movius's Partition of Two Paleolithic Traditions and Its Influence

Today, most archaeologists agree that the Early Paleolithic assemblages of China and East Asia differ in a number of fundamental ways from Lower and Middle Paleolithic assemblages of Africa and western Eurasia. For decades, Movius's partition of two cultural traditions and his hypothetical interpretations of it have dominated discussions.

Movius proposed two technological traditions in the Lower Paleolithic: one is the Acheulean handaxe tradition of Africa and western Eurasia, characterized by handaxes and other large bifaces. The other is the chopper-chopping tool tradition of East Asia, represented by simple core tools made of pebbles (Movius 1948). His explanation for this difference was that (1) East Asia is a marginal region of human biological and cultural evolution that somehow broke away from the mainstream of human development and maintained the technology of the earliest phase of human culture in an isolated context, and (2) the quality of raw material in East Asia was so poor that it would not permit the ancient population there to make better implements.

Even though Movius focused mainly on the Lower Paleolithic or the earlier period of the Chinese Early Paleolithic in the new scheme, his conceptualization has profound influence on the study of other periods, and Paleolithic research has somehow been placed under its shadow since then. For half a century, Chinese scholars have voiced some of the strongest opposition to the Movius Line. They criticize Movius's conception of "chopper-chopping tool" in the East, arguing that such artifacts are not typical and dominant in the East Asian Paleolithic complexes, that the Chinese and East Asian Paleolithic assemblages are not simple and homogeneous, and that a certain degree of cultural variability and innovation are evident in the archaeological record. Chinese researchers are also eager to demonstrate that some Western cultural elements, such as Acheulean tool kits and the Levalloisian technological products, are also presented in the East and that therefore there are no fundamental differences between the East and West and that East Asia was never a "cultural backwater" (Huang 1989*a*, 1989*b*, 1993; Huang, Hou, and Gao 2009). However, not everybody agrees with such a counterview. Some Western scholars still believe that Movius's "basic characterization of the major characteristics of early stage technologies in eastern Asia still holds up" (Schick 1994:579), and some Chinese researchers also made similar statements that Movius's basic observation and conclusion were still applicable to the Chinese Paleolithic materials before the Late Paleolithic (Lin 1994, 1996). In other words, attempts to support or invalidate the Movius Line hypothesis have become central to much Paleolithic research in China.

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The Controversial Hypothesis of Two Parallel Paleolithic Traditions in North China

An example of the Chinese archaeologists' attempts to denounce the Movius theory and to demonstrate the diversity of Paleolithic cultures in the region is the proposition of two parallel Paleolithic traditions in North China. This notion was first put forth in 1972 by Jia and colleagues (Jia, Gai, and You 1972) and was further developed later (Jia and Huang 1985). Basically, it states that there are two parallel lithic traditions in North China. One is the Kehe-Dingcun Series, characterized by large chopper-chopping tools and triangular points; the other is the Zhoukoudian Locality 1-Shiyu Series, characterized by small flake tools such as scrapers and burins. The two "traditions" were postulated as extending in parallel from the Early Paleolithic all the way into the Late Paleolithic and even the Neolithic and developing into two different agricultural patterns. This hypothesis had been influential and made significant impact on Paleolithic research in China during the last three decades of the twentieth century, and some researchers are still working in this domain up to the present.

Such a notion is quite troublesome. The sites of the two "traditions" are distributed basically in the same region, and it is difficult to imagine that two distinct cultural traditions can exist side by side in the same area for about a million years. Studies have revealed that most of the sites of the large-tool tradition, including the key site Dingcun, are in fact dominated by small flake tools (Zhang 1993). The most serious problem with the "large-tool tradition" is taphonomic: almost all the localities assigned to the "large-tool tradition" were fluvial sites exhibiting traces of disturbance and secondary deposition, and many of these large stone tools were selectively collected from the ground surface. Therefore, these collections could not represent a complete "assemblage" or "tool kit" and certainly not a "cultural tradition." Another drawback of this hypothesis is that it may well overlook or minimize variations within the specific lithic assemblages ascribed to each of these so-called traditions and, at the same time, potentially underestimate the similarities among industries of different "traditions." In short, the diversity and complexity of the lithic industries in China cannot be summarized simply by two unilinear traditions based solely on typological and morphological analyses.

Communication Obstacles and the Distinct Paleolithic Research Tradition in China

China has rich collections of Paleolithic remains. Many foreign researchers are eager to access the collections and to establish fruitful contact with colleagues there. However, they often feel frustrated; typical comments are "prehistorians outside of China have found it difficult to obtain good information about the results of this surge in archaeological inquiry, much less to synthesize a comprehensive understanding of Paleolithic trends in eastern Asia" (Schick and Dong 1993: 22) and "the number of well-documented Lower Paleolithic sites remains very small, and the credibility of some of the industries must be questioned because of limited investigation or the lack of the firm chronometric data. Because of these problems, it is unreasonable to expect very sophisticated treatment of specific areal, temporal, and cultural topics. Students will find much of the literature very limited from theoretical and methodological perspectives and rather vague when compared with that of better-studied areas" (Yi and Clark 1983: 181).

Today, Chinese Paleolithic research and Chinese archaeology as a whole still maintain an ambiguous relationship with Western practice and theory. Several factors could be responsible for this. (1) Language: most of the site reports and research papers by the Chinese researchers are published in Chinese journals, and the language barrier prevents Chinese and foreign scholars from sharing information and exchanging ideas freely. (2) Different research priorities: a large part of archaeological activities in China are undertaken as salvage projects, and rescue of the artifacts or cultural relics and basic classification and description rather than detailed analysis and theoretical explanations are the principal tasks of the fieldworker. (3) The profound impact of traditional epigraphy on modern archaeological practice helps maintain a long-lasting and persistent classification and description tendency, and the political situation, especially the adoption of Marxism and Maoism as notional ideology by the New China, strengthened the tradition. (4) Believing in the philosophy that scientific reasoning should be very cautious and that one has to accumulate enough data before reaching meaningful conclusions, most Chinese scholars are reluctant or lack confidence to touch theoretical issues, and if they have to do so, they would like to take an inductive approach rather than being deductive. (5) A strict and somewhat exclusive government policy regarding foreigners' involvement in archaeological research in China, especially fieldwork, makes it difficult for foreign scholars to get firsthand information and experience and to establish long-term research programs there. We should also draw attention to the fact that compared with the large size of the country and the rich archaeological materials, the Paleolithic research community in China is very small, and the number of well-trained professional researchers familiar with global methodological and theoretical approaches is inadequate. In addition, many Chinese researchers are accustomed to doing research in their own territory and seldom go beyond its border, even within China.

I would argue that the difficulties and differences in language and research practices are superficial. The more fundamental reason that the Chinese record plays such a limited role in discussion of evolutionary trends within the Middle and Late Pleistocene is that the archaeological evidence is still difficult to reconcile with what is known from Europe and Africa. Chinese and eastern Asian Paleolithic materials really are different from those of the West in many ways; their unique types and morphological and developmental features

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make Western typology and terminology difficult to apply, and many Western scholars do not fully understand them. They expect to find similar cultural remains and familiar research results, but they are often disappointed. We have failed to work out a typological-descriptive system and research norms that can be effectively applied to archaeological materials from both the West and the East.

The Chinese LEP Archaeological Record: Uniqueness versus Divergence

Literally hundreds of archaeological sites estimated to belong to the 300–40 ka time span have been reported in China (fig. 1). The exact figure is hard to calculate, for some sites were assigned a wide chronological range, and it is difficult to say whether they belong to this stage; and in some regions, many localities were identified and numbered, and it is difficult to determine whether they belong to one site or discrete sites. I will describe a few key sites to provide some basic information.

Key Sites

Miaohoushan. Miaohoushan is a cave site situated near Benxi City, Liaoning Province, in Northeast China (Zhang 1989). It was discovered in 1978 and excavated in 1978, 1979, and 1980. A few human fossil fragments, probably of archaic *Homo sapiens*, numerous mammalian fossils, some stone artifacts, and ash and burned items were unearthed from several cultural horizons. These cultural remains were generally dated to 140–250 ka, and even older ages were suggested (Wei 2009; Zhang et al. 2007). A total of 64 lithic artifacts have been reported and analyzed, including simple cores, flakes, and retouched pieces. Direct hammer percussion was used as the principal method of core reduction; core preparation was seldom applied. The tools were fabricated coarsely, and the artifacts vary greatly in size and morphology. Side scrapers are the dominant tools, and most of them are small; chopper-chopping tools take the second position, and some of them are very large.

Jinniushan. Jinniushan is a cave site complex located near Yingkou City, Liaoning Province, Northeast China. It was discovered in 1974 and excavated in the 1970s and 1980s (Lü 2004). The excavations resulted in the discovery of a partial skeleton of archaic *Homo sapiens*, numerous mammalian fossils, and stone artifacts. A few hearths covered by rocks believed to be evidence of fire preservation, along with burnt materials, were also unearthed. Several chronometric tests have been applied to the human fossil and artifact-bearing horizons, and ages of 230–300 Ka, 228 Ka, and 187 Ka were reported (Chen, Yang, and Wu 1994). Only a part of the unearthed materials has been analyzed and published. Ac-

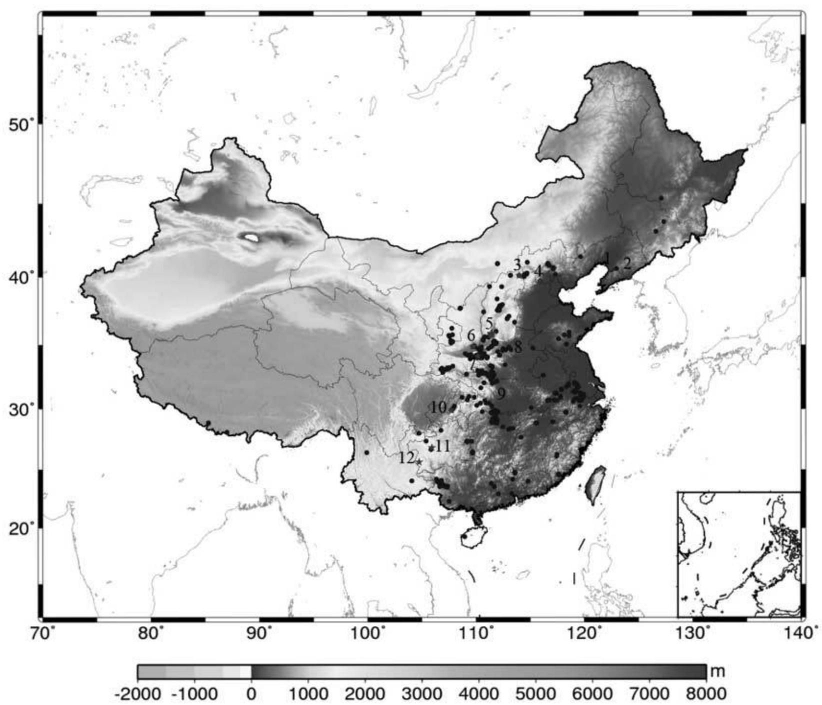

Figure 1. Key localities among major LEP sites in China. 1, Jinniushan; 2, Miaohoushan; 3, Xujiayao; 4, Zhoukoudian Locality 15; 5, Dingcun; 6, Dali; 7, Longyadong; 8, Lingjing; 9, Jigongshan; 10, Jingshuiwan; 11, Guanyindong; 12, Dadong.

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cording to the available information, the lithic assemblage includes simple cores, flakes, scrapers, points, and burin. Core reduction was mainly carried out through direct hammer percussion without core preparation, and the bipolar technique was also used. The tool kit is dominated by side scrapers, and retouch on them is simple and casual. Most artifacts are small and vary in size and morphology. Some chipped-bone tools were also believed to be produced and used.

Zhoukoudian Locality 15. Zhoukoudian Locality 15 is part of the limestone cave complex of the Zhoukoudian site, located 50 km southwest of Beijing. The locality was discovered in 1932 and excavated from 1935 to 1937. A large quantity of vertebrate fossils and lithic artifacts was unearthed. Faunal assemblage indicates a late Middle to early Upper Pleistocene age, and limited uranium series dates estimated an age range between 140 and 110 ka for the cultural horizon (Gao 2000). The rich lithic assemblage is composed of more than 10,000 stone artifacts, including hammerstones, cores, flakes, retouched pieces, and chunks, with the latter predominating. Hammer percussion was the principal flaking strategy, but bipolar flaking was also employed frequently, which made the assemblage unique in the Chinese LEP and a clear successor of the earlier "Peking Man" industry known from Zhoukoudian Locality 1. In addition to the simple cores, regular discoid cores and heavily reduced polyhedral cores were also present, testifying to a sophisticated fashion of core reduction. The retouched tools are mostly side scrapers; other tool types include chopper-chopping tools, backed knives, points, awls, notches, and burins (fig. 2*B*). The tools are mostly fabricated on flakes and are small in size, but the few pieces of backed knives or cleavers are large and distinctive. Most of the artifacts were fabricated from locally available quartz, a raw material source characterized by high abundance and low workability. An analysis of raw material utilization reveals that some simple but practical and efficient strategies were adopted to make use of these raw materials: different materials were procured and consumed differently (table 1); the site was provisioned with abundant potential tool-making materials; numerous flakes were detached, but only a portion was selected for modification and utilization (Gao 2003).

Dali. Dali is an open-air site discovered in 1978 in Shanxi Province, North China, and is best known for the presence of an archaic *Homo sapiens* skull (Wu 2009), but some faunal remains and 564 pieces of stone artifacts were also collected from sandy deposits. U-series and electron spin produced an age range between 380 and 140 ka (Chen, Yuan, and Gao 1984; Yin et al. 2001). Core reduction at the site was found to be conducted through hammer percussion and the bipolar method. Most of lithic artifacts are very small side scrapers, points, burins, and drills produced from quartzite, flint, and quartz materials. Retouch on these pieces is very simple and casual, and some of them were heavily worn and difficult to study typologically and technologically.

Dingcun. The Dingcun site complex is located in Shanxi Province, North China, and was originally discovered in 1953. The site is made up of a dozen separate open-air localities. Several excavations have been carried out at the site; a parietal skull and some isolated teeth of archaic *Homo sapiens* and a large quantity of vertebrate fossils and lithic artifacts were collected. U-series dates and lithostratigraphic and biostratigraphic reconstructions indicated an age range of 260–107 ka for the cultural remains (Norton, Gao, and Feng 2009).

For a long time, the rich lithic collection from the site has been the center of discussion and debate in Paleolithic research in China. Jia nominated Dingcun as the representative site of the "large chopper-chopping tool and triangular point tradition" of North China, for most of the artifacts were considered to be large ones, and some of them exhibited distinctive typological and technological features. Huang put forward the notion that many large pointed tools in the assemblage were handaxes; therefore, Dingcun was the center of a handaxe zone along the Fen and Wei rivers in North China (Huang 1989*a*). However, close examination of the collections reveals that the assemblages are dominated by small flake tools, mainly side scrapers and points, not large pebble tools, and there are no real handaxes from the site (Gao 2011). Still, the Dingcun industry shows some special characteristics within the flake-tool techno-complex in China in that core reduction, even though still through simple hard-hammer percussion and possible anvil technique, seems to be more sophisticated, and many large and regular flakes and tools were produced. Some large well-made triangular picks made on flakes with unique morphology as well as chopper-chopping tools and spheroids were also present (fig. 2*D*). A major reason for the uniqueness of the Dingcun industry might be the exploitation of high-quality dark hornfels available in nearby river beds.

Xujiayao. Xujiayao is a fluvial-lacustrine open-air site located in the western margin of the Nihewan Basin in Hebei Province, North China (Jia, Wei, and Li 1979). It was excavated three times in the late 1970s and more in recent years. Some fragmental archaic *Homo sapiens* fossils and an array of vertebrate fossils and Paleolithic materials were recovered. U-series, paleomagnetism, and optically stimulated luminescence (OSL) dating have been applied to the site, and dates of 125–104 ka, 117 ka, and 69 ka have been obtained, respectively (Chen et al. 1982; Liu, Su, and Jin 1992; Nagatomo et al. 2009). A recent study on 1,765 lithic artifacts unearthed in 1977 indicates that the assemblage includes cores, flakes, retouched pieces, chunks, and debris (Ma, Pei, and Gao 2011). Raw materials were mainly quartzite and quartz pebbles selected from nearby river beds, simple hammer percussion was used for core reduction, and a certain number of discoid and polyhedral cores were left behind. About half of the retouched pieces are small side scrapers made on flake blanks, and spheroids constitute more than 27% of the assemblage, which is very distinctive. Other tool types include point, notch, den-

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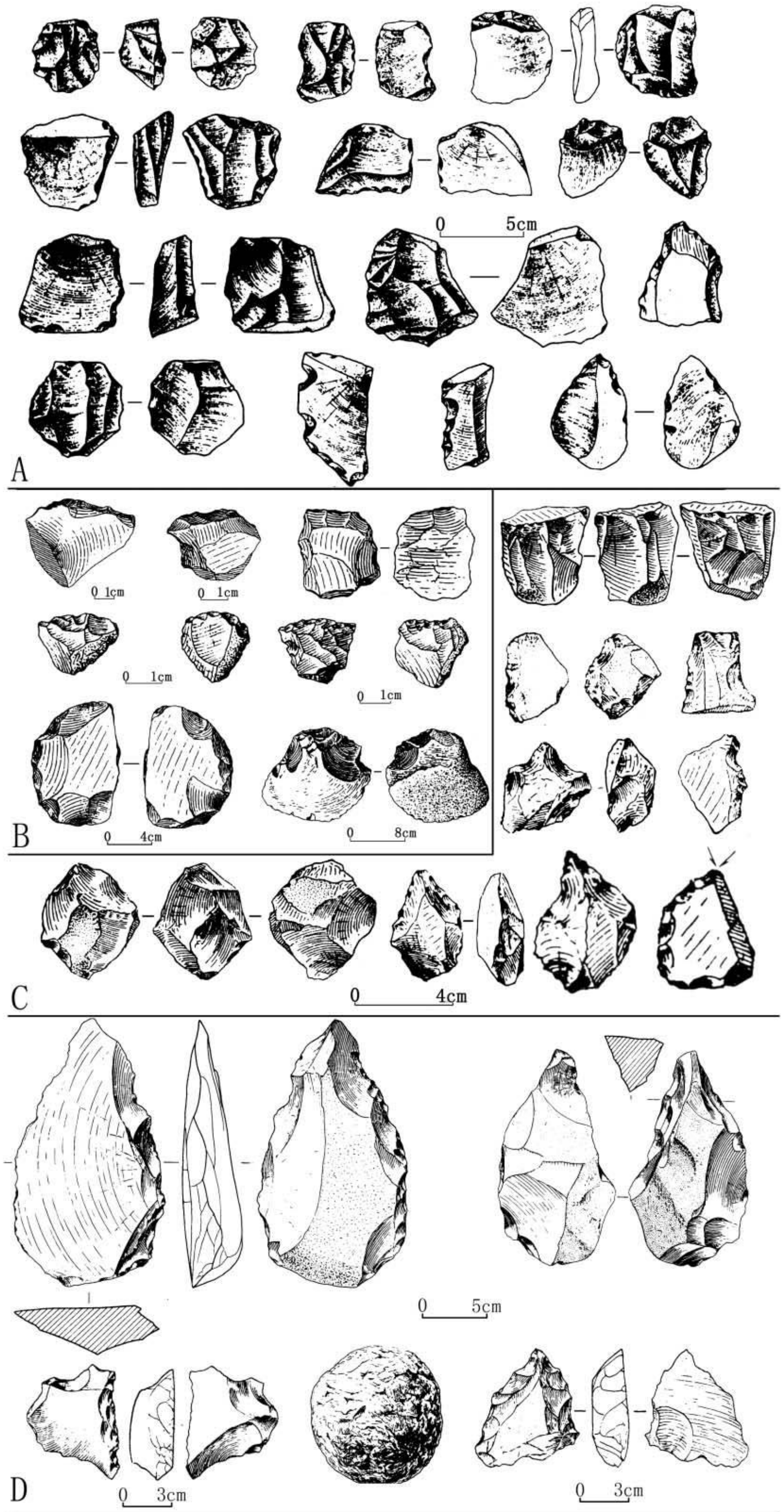

Figure 2. Line drawings of stone artifacts from some key LEP sites in North China. *A*, Longyadong; *B*, Zhoukoudian Locality 15; *C*, Xujiayao; *D*, Dingcun.

Table 1. Raw material frequencies for artifacts by class from Zhoukoudian Locality 15

	Quartz		Igneous		Crystal		Flint		Sandstone		Quartzite
Class	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*
Core	126	1.8					2		1		1
Flake	393	5.7	113	1.6			15	.2	9	.1	
Bipolar	86	1.3			1						
Hammer			5	.1					2		
Chunk	4,730	68.9	32	.5	66	1.0	1				
Tool	1,198	17.4	54	.8	14	.2	12	.2	4	.1	1

ticulate, chopper-chopping tools, burin, and drill tools (fig. 2*C*). Some bone tools were also recognized in previous studies. Because of the high density of equid and rhinoceros bones and artifacts, particularly stone spheroids and bone tools, Xujiayao was interpreted as a horse kill site.

Lingjing. Lingjing is an open-air site located near Xuchang City, Henan Province, central China. The site was discovered in the mid-1960s and excavated recently. A broken skullcap of possible archaic *Homo sapiens* was unearthed in association with a large quantity of mammalian fossil fragments and thousands of stone tools. OSL dates and biostratigraphic data estimate the age of 110–80 Ka for the Paleolithic horizon. The lithic assemblage is dominated by small side scrapers, points, and drills made of vein quartz flakes, but some heavy-duty chopper-chopping tools and picks made of quartzite blank are also present (Li 2007). Core reduction and tool manufacture are found to be simple and casual. Some modified bone tools, mostly pointed ones, have been identified and analyzed (fig. 3), and use-wear analysis results suggest that some bone tools were used for drilling, penetrating, and scraping animal substances and that some might have been hafted during use (Li and Shen 2010).

A study of mortality profiles of the large herbivores from the site suggests that the accumulation of rich mammalian bone fragments is the result of human hunting and butchering. Aurochs (*Bos primigenius*) and horse (*Equus caballus*) are the major prey species, and the age structures of these animals can be best described as the "prime-dominated pattern." This study confirms the well-established notions at many Middle and Upper Paleolithic sites across Eurasia and Africa that Middle Stone Age/Middle Paleolithic foragers were fully effective in hunting large prey species, particularly aurochs and horse, which might indicate that the hunting behaviors and subsistence strategies were not significantly different between Middle Paleolithic and Upper Paleolithic humans in East Asia and hence suggest the early emergence of modern human behaviors in this area (Zhang et al. 2009).

Sites in the Luonan Basin. Since 1995, more than 300 sites have been found in the Luonan Basin of southern Shanxi Province, central China. Among them, only Longyadong is a cave site, and the others are open-air sites. Tens of thousands of stone artifacts have been collected from different river terraces along the Luonan River, and most of them are surface finds (Wang 2005). Paleomagnetism and OSL dating suggest that ancient humans stayed in the area off and on in the time span of 800–140 ka (Lu et al. 2007). These sites have attracted a great deal of attention in China because of the discovery of a certain number of Acheulean-like handaxes, cleavers, and picks along with other large pebble tools and small flake tools (fig. 2*A*). Raw materials used for stone-tool manufacture are overwhelmingly quartzite pebbles. Such a tool kit is quite unique in central-southern China's pebble-tool zone in which simple and large chopper-chopping tools dominated the industries throughout the Paleolithic. Recent excavation and chronometric dating suggest that some of the Acheulean-style artifacts might come from the Upper Pleistocene horizon, which may present challenges to the study of Paleolithic human adaptation, migration, interaction, or convergent cultural development.

Jigongshan. The Jigongshan site is situated in the Jingzhou district of Hubei Province along the Yangtze River. It was discovered in 1984 and excavated in 1992. Numerous lithic materials were unearthed from two cultural horizons at the site. The lower horizon was estimated to be of the early Upper Pleistocene and the upper horizon of the late Upper Pleistocene. Lithic assemblages from the two horizons were dominated by simple cores, flakes, and chunks. Most of the tools from the lower horizon were made of pebbles, and heavy-duty tools such as picks and chopper-chopping tools make up the large majority of the assemblage (fig. 4*D*). Tools from the upper horizon were mostly made on flakes, and most of them are small irregular scrapers. According to the site report (Liu and Wang 2001), the "living floor" with a circular structure composed of pebbles and artifacts was identified from the lower cultural horizon.

Sites in Sanxia (*Three Gorges Region*). More than 20 Paleolithic sites have been discovered and excavated in the Three Gorges Region (*Sanxia* in Chinese) in Chongqing Municipal City, central China, in the past two decades, and some sites have been dated to the time span of 140–70 ka, such as Jingshuiwan (Gao and Pei 2010; Pei et al. 2006). Lithic artifacts from these sites are typical of the pebble-tool industries that prevailed in southern and central China during the entire Pleistocene. Assemblages are dominated overwhelmingly by large chopper-chopping tools and picks made of pebbles. Only a small portion of the tools were fabricated on flake blanks.

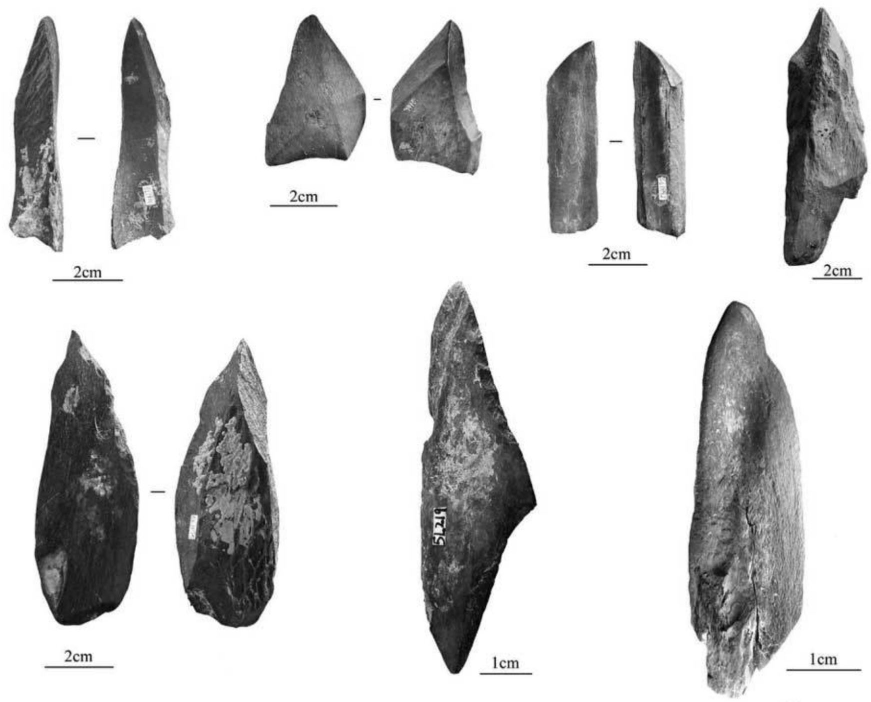

Figure 3. Possible bone tools from Lingjing.

Raw materials exploited are mostly quartzite and quartzite sandstone. Core reduction was carried out using direct hammer percussion and a kind of special "throw and collision method." Only simple cores and flakes were produced. Retouch of tools was simple and casual (fig. 4*A*).

Dadong (*Grand Cave*). The Dadong or Grand Cave site is located in Guizhou Province, South China, and was discovered and excavated in 1990s. More than 2,000 artifacts have been unearthed (Huang, Hou, and Si 1997), and the age of human occupation of the site has been estimated to be 260–142 ka (Wang et al. 2003). Raw materials exploited are mostly small flint nodules. Only direct hard-hammer percussion was employed for core reduction, and a few Levallois-like flakes were reported. The assemblage is dominated by small flake tools, including side scrapers, drills, notches, denticulates, and end scrapers (fig. 4*C*). A few pieces of rhinoceros teeth were identified as modified into scraping tools.

Guanyindong. The Guanyindong cave site is also located in Guizhou Province, South China, and was discovered and excavated in the 1960s (Li and Wen 1986). More than 3,000 stone artifacts and numerous animal fossils were unearthed from two depositional units. Stone-tool raw materials exploited are locally available flints. Direct hard-hammer percussion was believed to be used for core reduction and retouch, and a few Levallois-like flakes were identified. A rich variety of tool types were recognized from the assemblage, including side scrapers, end scrapers, notches, denticulates, points, drills, burins, and chopper-chopping tools; most of them are small flake tools (fig. 4*B*). The retouched pieces exhibit a simple and irregular mode of modification; some of them possess more than one cutting edge, and the edges are usually thick and steep. The Guanyindong site was initially estimated to be of Middle Pleistocene age, and the cultural remains were believed to be comparable with those of the Peking Man site at Zhoukoudian. However, later chronometric dating placed the lower horizon at 50–140 ka and 180–240 ka and the upper horizon to be younger than 40 ka (Shen and Jin 1992).

Principal Features of the Chinese LEP Paleolithic Assemblages

It is obvious that Early Paleolithic industries in China have their unique features compared with contemporary cultural remains in Africa and western Eurasia. The most distinctive cultural characteristics of the Chinese LEP Paleolithic assemblages can be summarized as follows.

1. Slow or conservative development process in that Mode I technology and assemblages prevailed for all the LEP. Most of the assemblages consist of simple cores, irregular flakes, side scrapers, chopper-chopping tools, points, picks, and so forth. It is true that Acheulean-like tool kits, including handaxes, cleavers, and picks were reported from some localities of the Luonan Basin and the Dingcun site. Some Acheulean-like assemblages from the Luonan Basin were estimated to be of the late Middle Pleistocene or even the upper Pleistocene.

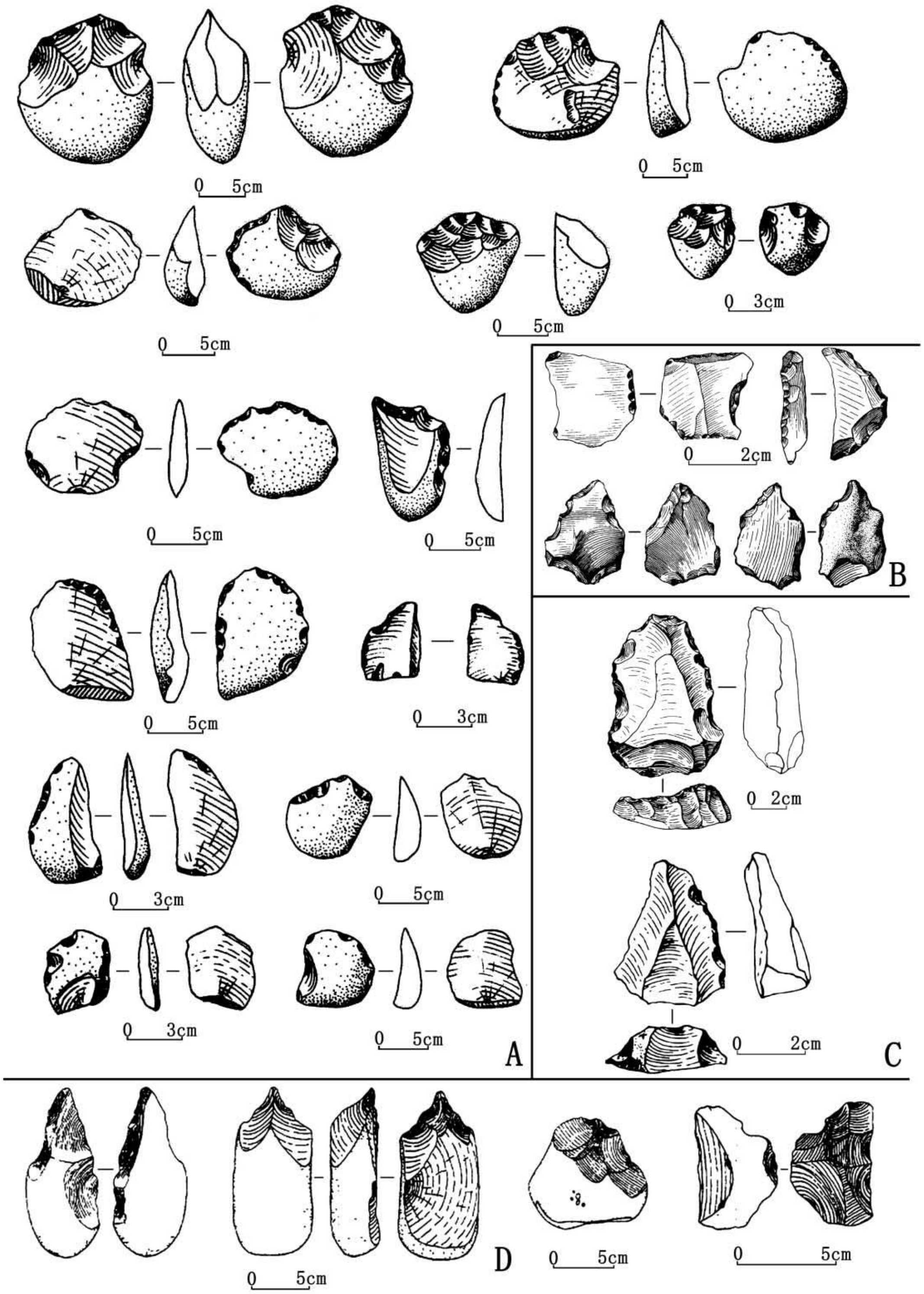

Figure 4. Line drawings of stone artifacts from some key LEP sites in South China. *A*, Jingshuiwan; *B*, Guanyindong; *C*, Dadong; *D*, Jigongshan.

However, most of these artifacts are surface finds, and the age of such assemblages needs to be further analyzed. Furthermore, handaxes found in this region are mostly pointed and thick, and no trace of soft-hammer retouch and thinning (typical of contemporaneous industries in Europe, the Near East, and Africa) can be observed from the samples. No real handaxes or cleavers were collected from the Dingcun site, and no technological mark of soft-hammer flaking and thinning can be identified from the artifacts. Before 40 ka, no Mousterian-style assemblages or blade technology can be identified in the Chinese Paleolithic industries.

2. Only local raw materials were exploited for tool making, and they are mostly poor-quality quartz, quartzite, sandstone, and silicified limestone. At some sites chert and flint were used, but they are usually of poor quality and in small nodules. No evidence of quarrying and long-distance transportation of high-quality raw material has been detected so far.

3. A variety of flaking methods used for core reduction is evident in these industries, including direct hard-hammer percussion, bipolar, and block-on-block techniques. Cores were rarely prepared, and no application of real Levalloisian technique was recognized. Simple cores with a few detach-flake scars and polyhedral ones are the most numerous, and discoidal cores appear in some assemblages. Flakes are usually small, irregular, and vary in size and morphology. Evidence for "predetermination" of flake shapes by core preparation is lacking. No trace of soft-hammer flaking has been recognized for this period of time.

4. Tools are mostly simple, irregular, and casually modified, and some are difficult to classify into discrete types. In the north—that is, to the north of the Qinling Mountains and the Huai River, a natural boundary that normally divides China into two ecological zones—industries were mostly dominated by small flake tools such as side scrapers, points, and drills supplemented by chopper-chopping tools, picks, and spheroids, while in the south, industries were dominated by large pebble tools, especially chopper-chopping tools and picks. Generally speaking, the degree of tool standardization is pretty low, and flakes were frequently utilized without further modification. There are certainly exceptions. Some large and well-made digging-cutting tools were collected from a few localities in the Dingcun site complex and the Luonan Basin, such as triangular picks, handaxes, and cleavers, and some small flake tools, such as side scrapers and points, unearthed from sites such as Zhoukoudian Location 15 and Guanyindong, are found to be fabricated delicately and skillfully. It might mean that when raw material was suitable and necessity arose, human groups living at these sites were capable of producing regular, efficient and curated tools.

Any attempt to summarize the basic features of the Chinese LEP as a whole is inevitably oversimplified. While the fact that Paleolithic industries in China and East Asia are different from those of the West has been recognized, regional diversity and internal complexity are also evident in these industries. China covers a vast and geographically/ecologically diverse area, and it is more appropriate to think about regional findings according to paleoecological conditions rather than treating the vast territory as a whole.

The complexity of Early Paleolithic industries in China and their regional variability have been realized in the past three decades. Zhang Senshui's observation of "two main Chinese Paleolithic industries with numerous local cultural variants" is a good example (Zhang 1999:198). He proposed that two principal industries could be recognized from the Chinese Paleolithic remains, that is, the small flake tool industry in North China and the large pebble-tool industry in South China. He called them the northern main industry (NMI) and the southern main industry (SMI), respectively. Within these two cultural zones, divided by the Huai River in the east and the Qinling Mountains in the west, he further recognized numerous local cultural variants. Major features of NMI were summarized as including the domination of small flake tools, mainly various kinds of side scrapers, points, awls, burins; large pebble tools, such as chopper-chopping tools, picks, and spheroids, were of secondary importance; direct hammer percussion, the bipolar technique, and the block-on-block method were used for flaking; and the industries exhibited slow and conservative development during the Early Paleolithic but showed acceleration of technological development and innovation as well as the emergence of new techniques and tool types (such as blade and microblade tools and technology) in the Late Paleolithic. Meanwhile, characteristics of SMI include the domination of large pebble tools, mainly chopper-chopping tools, picks, and handaxes; rarely present and poorly fabricated scrapers and points; hammer-percussion and block-on-block methods used for core reduction; fewer clear tool types and coarser retouch compared with NMI; and a much stronger conservative developmental trend even all the way to the early Neolithic. On the basis of the partition of the north versus the south cultural zones and the formation of many regional cultural variants, Zhang pointed out possible factors, such as environmental differences and human migrations and interactions, but was short of detailed analysis.

Simple stone-tool technology and assemblage and slow development of the Chinese LEP should not lead to the conclusion that they are stagnant. In fact, changes and development in these industries are still evident through time. Zhang Senshui (1989) summarizes the major developmental trends of the Chinese Lower Paleolithic as follows. (1) More and more high-quality raw materials were exploited, especially silicified limestone and flint. (2) Direct hard-hammer percussion technique underwent a discernible process of maturation while block-on-block techniques diminished in importance. (3) Morphologically regular flakes and tools made on them increased in number. (4) More flakes were used as tool blanks, and even in the pebble-tool zone of southern China, flake tools increased through time. (5) more tool types were added to the assemblages, and the discrepancy between tool classes became clearer. (6) Chopper-chopping tools became less common, and points and drills in accordance increased and became more regularized. (7) Through time, more delicately retouched tools increased in number. (8) Retouch changed from multidirectional to mainly unidirectional on the dorsal surface. Such technological and morphological change or development is not as obvious and dramatic as what happened to the Early and Middle Stone Age or Lower and Middle Paleolithic in the West. However, they provide us the opportunity to think about and reconstruct different or alternative trajectories of human evolution during the remote past.

Discussion

For a long time, discussions of technological similarities and differences between Paleolithic tool traditions have been frequently based on assumptions regarding what biological affinities may indicate about cultural ties and vice versa. Such assumptions are not always borne out in the real world when we realize that biologically closely related populations sometimes exhibit fundamental differences in their social structure and even language, and culture and technology can be transmitted quickly between geographically distant groups (Schick 1994). Therefore, archaeologists must pursue alternative hypotheses to explain cultural variability.

Other than the Movius Line theory, many hypotheses have been proposed to interpret the unique features of Paleolithic industries in China and East Asia. A few researchers have suggested that the main tools used by Paleolithic humans for adaptation in the region were those made from bamboo and wood materials, and the simple stone tools were actually used to make such vegetal tools. Therefore, stone artifacts are not the right indicator of human technological development and adaptive strategy in the Pleistocene (Pope 1989). Some proposed that the lack of high-quality raw material in East Asia was the major obstacle for ancient populations living in the region to develop more sophisticated lithic technology and make stone tools as good as those of Africa and western Eurasia (Schick 1994). Some even suggested that when early human groups migrated into East Asia, they first encountered tropical and subtropical ecological conditions in the southern part of the territory. In such environments, foods were obtained mainly through gathering plant fruits and roots rather than hunting game; large hunting and butchering tools were useless, and simple pebble and flake tools took the dominant role. Such a shift of survival conditions and adaptive strategies brought about fundamental changes to stone-tool technology and the composition of tool kits, and the watershed in Paleolithic industries between the East and the West began to appear (Watanabe 1985).

The above hypotheses all offered some explanations on the distinctive features of Paleolithic remains in China and East Asia and cultural differences between the East and the West in most of the Pleistocene. However, such discussions are often confined to some isolated factors, such as geographic isolation, restrictions of raw materials, and ecological/environmental conditions, and some theories are short of supporting evidence. The formation of a lithic industry or of a certain cultural tradition should be a complex process that might involve many influencing factors. Maybe it is time to work out a model that is more comprehensive and takes an integrative approach to consider both environmental effects and human behavior and adaptive strategies. I call it a "comprehensive behavioral model." The model may offer the following observations and explanations on the stable development and unique features of Early Paleolithic industries in China.

Stable Environments and Continuity of Human Evolution

During the LEP, China was under the control of monsoon climates. Studies of Loess depositional sequence and faunal assemblages suggest that even if climatic fluctuations occurred periodically, environmental conditions were relatively stable in the region, and most of the area was suitable for human habitation (Liu 2009). Rich and continuous archaeological records indicate that human evolution in the region was stable and uninterrupted and without large-scale population replacement. Strong and stable cultural traditions were formed during this process, and occasional outside intruders were assimilated into the mainstream populations and lost their cultural identities.

Low-Intensity Resource Exploitation and High Mobility

Most of the LEP sites in China are seasonal, short-time occupied ones, and artifacts collected from them are mostly simple and share basic features of technology, typology, and morphology, which may indicate that human groups living in the region had a simple and "easy" hunting-gathering lifestyle. They kept the exploitation of natural resources at a rather low intensity and seldom felt the pressure of innovating lithic technology to procure difficult resources. In keeping such a lifeway, they moved frequently to other places to find new food resources, and therefore they left identical artifacts and other materials at many sites in certain regions.

High Flexibility in Tool Technology and Adaptation

The lack of high-quality stone raw materials and suitable quarrying sites forced Early Paleolithic humans living in the area to make best use of poor-quality and locally available raw materials. In dealing with such materials with great variability in lithology and morphology, these people learned to be highly flexible and use simple but suitable and effective ways to produce tool blanks and make stone tools. For instance, people living at Zhoukoudian Locality 15 relied heavily on the bipolar technique to make use of quartz nodules that were abundant in the nearby river bed. People living at the Dingcun site applied the hammer-percussion method skillfully to dark hornfels, a relatively high-quality local raw material, to detach large and regular flakes and to produce large and sharp cutting and digging tools. Still, people in the Sanxia region invented the unique "throw and collision method" to exploit highly polished and rounded river pebbles. Such flexibility might have enforced ancient human survival capability and helped the Paleolithic traditions to be strong, stable, and full of vitality. If the Bamboo Tool hypothesis can be verified, it will be a good example of the flexibility and intelligence of ancient humans living in the region.

Conclusions

It is obvious that the LEP industries in China and East Asia are different from those of contemporary Paleolithic remains in Africa and western Eurasia in many ways. However, it is also clear that the Lower Paleolithic world should not be simply divided into two different cultural/technological traditions based solely on stone-tool technological and typological comparisons. The variation in Paleolithic industries between the West and the East is undeniable, but it should be understood within a broad framework of universal cultural diversity. It should be realized that while ancient hominids in different parts of the world shared some basic lithic technologies and produced and utilized similar stone tools (such as core/flake tools), each group was unique in its methods of survival and adaptation because of ecological context and raw material availability and quality. What is more important is to look beyond lithic technological and typological variability and find the factors and dynamics behind such cultural differences and reconstruct different pathways of human evolution toward complexity and modernity.

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