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CHINESE PALAEOLITHIC CHALLENGES FOR INTERPRETATIONS OF PALAEOLITHIC ARCHAEOLOGY

ABSTRACT: The development of prehistoric studies in Europe and Western Asia has powerfully influenced the terminology and conceptual frameworks of Palaeolithic archaeology. However, attempts to impose these on archaeological records elsewhere, such as East Asia, risk seriously distorting interpretations of the material and a failure to appreciate its significance. In particular, the Chinese Palaeolithic record provides major contrasts with that of Europe and Western Asia, and challenges prevailing notions of hominins' cognitive and adaptative capabilities based primarily on the lithic analysis. Early hominins beyond Africa were not tied to savanna environments and were able to exploit a range of habitats as a result of the flexibility afforded them by social and cognitive developments. Similarly, cultural influences conserved stone technologies, so that there is no necessary link between tool forms, cognitive ability and habitat characteristics. However, study of tool reduction sequences provides insights into the learning processes underlying the production of particular assemblages. Core and flake industries persisted in China for much of the Pleistocene, and while hand axe assemblages are known from the south of the country, they differ from those found in Europe and Africa. Levallois and several other Middle Palaeolithic industries are generally absent, although some instances are known from western and northern areas of the country. Early (> 25 kya) microlithic industries occur in north China, with late cobble tool assemblages in the south, probably coincident with the extent of bamboo forests. South China also provides examples of pottery from Upper Palaeolithic contexts dating from < 20 kya. The implications of these distinctive aspects of the Chinese archaeological record for understanding past human behaviors are briefly discussed, as are some more general issues associated with modeling early human cognition.

KEY WORDS: China Palaeolithic – Chronology – Knapping skills – Handaxes – Microblades

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INTRODUCTION

Prehistoric research was initiated in Western Europe during the 19th century and produced a set of widely accepted observations and terminologies deemed essential for reporting basic information concerning Pleistocene and Holocene sites and lithic industries in the Old World. The fundamental achievements in establishing the Palaeolithic-Neolithic sequences in Western European and Southwestern Asian countries were so effective that during the 20th century through European and American pioneering projects and local East Asian archaeologists trained in Western universities, the same research approach was adopted in China (e.g., Bar-Yosef, Wang 2012 and references therein, Gao 2013, Wang Y.-P. 2005). The search commenced first by foreign and then by local

FIGURE 1. A map of the provinces of China.

archaeologists with the goals to uncover the Palaeolithic and Neolithic remains that would establish the antiquity of Chinese civilization. Thus the investigations were, and still are, motivated by the wish to identify Lower, Middle and Upper Palaeolithic sites, as well as Mesolithic and Neolithic ones. In certain parts of this country, which is a geopolitical entity and not a geographically defined territory, evidence for lithic industries that resemble western Eurasian contexts has been found. These are concentrated in the north-east provinces (Jilin and Heliongjinag) (*Figure 1*), extending into Siberia and several regions within the western provinces (Gansu, Ningxia) where past connections with the Altai region are archaeologically recorded. But within the main part of the Chinese landmass, the prehistoric sequences, as known today, neither chronologically nor culturally fit within western Eurasian basic terminologies or sequences.

In defining the Neolithic Revolution V. Gordon Childe's work enjoyed the same impact in China as in western Eurasia. From his list of hallmarks for this economic and social revolution Chinese archaeologists picked the presence of pottery as the most essential character. Today it is known that pots were made by foragers at least 10,000 years earlier than in the west (Wu *et al.* 2012). The subsistence changes in Childe's definition are now becoming better understood with information about the emergence of millet and rice cultivation beginning to accumulate together with evidence for the domestication of pigs (e.g., Cohen 2011). However, the main comments in this eclectic review will refer only to the Palaeolithic.

In order to demonstrate the challenges that Chinese prehistory poses to Western concepts and accepted notions I briefly summarize the most relevant Plio-Pleistocene terminologies, cultural hallmarks and interpretations of Stone Age assemblages, coined in western Eurasia. I will then try to demonstrate that several of these interpretations make no sense in understanding the prehistoric remains of central and south China. For this summary I have minimized the number of references as I assume that most readers are familiar with the issues raised. My comments are not meant to criticize Western notions but to stress, among others, several unfortunate misunderstandings that today accompany the adoption of old European geomorphological and archaeological terms in China, as well as the common concepts often used in western literature concerning Pleistocene lithic industries. My observations are based on two decades of fieldwork and visits to numerous Palaeolithic and early Neolithic sites and collections in China. They are limited, as stressed above, to the major part of central-southern of China and are not intended to cover the entire landmass of East Asia.

If we itemize the main foundations of Palaeolithic research conducted since the early 19th century in Europe, Western Asia and Africa, we will stress the geological stratigraphies, their radiometric dating, reconstructed Plio-Pleistocene-Holocene environments, and the social interpretations of the archaeological and human fossil records. The studies of these aspects led among others to the establishment of chrono-stratigraphic climatic and cultural sequences of the Palaeolithic and its subdivisions (Lower, Middle and Upper Palaeolithic), Mesolithic and Neolithic phases that are characterized on the basis of common knapping techniques and special tool-types. The making of objects and body decoration from a wealth of materials such as hard rocks, wood, antler, bone, ivory, and shells serve as cultural markers but seem in many instances to have appeared initially in Africa (e.g., McBrearty, Brooks 2000). Detailed geoarchaeological and micromorphological analyses illuminate, when employed, site formation processes. Similarly, zooarchaeological investigations identify patterns of breakage, cut and gnawing marks which, together with microscopic use wear, isotope and chemical analyses, pollen and Non-Pollen Palynomorphs, all contribute to the cumulative nature of the available behavioral and environmental evidence.

In the following pages I will try to indicate what is known today about Mainland China that does not fit well with the chrono-cultural schemes of western Eurasia. Not less problematic are the implications of the proposed cognitive interpretations and behavioral patterns suggested for the African and western Eurasian records of artifacts when compared to what is known about the prehistory of the Chinese mainland.

PLEISTOCENE STRATIGRAPHIES AND PALAEOENVIRONMENTS

The stratigraphies of Pleistocene river terraces in Western Europe, first recognized as designating the four Alpine glacial phases, assisted in establishing the Palaeolithic sequence and its relative chronology. Later, older stages were added to the original four, while during the second half of the 20th century newly developed radiometric techniques, coupled with palaeomagnetism, extended the time range of the Pleistocene from 0.660 Ma to 2.6 Ma as dated sequences of environmental and evolutionary changes became available (e.g., Klein 2009, Zeuner 1958).

The old European concept of four Alpine glacial cycles was adopted by Chinese scholars as a reference to "four river terraces". Thus most reported Palaeolithic sites in China are attributed to one of the four terraces in every river valley across the country. The presence of systematically down cutting in every river valley in the mainland and documenting the four Quaternary terraces was never fully published. However, archaeologists are fully aware that relatively recent sites, for example of Upper Pleistocene age, can be found on top of an older terrace, and that older sites could be embedded in more recent terraces. With the advent of radiometric techniques, the notion of four terraces may eventually disappear unless directly related to landscape changes in a given area.

The study of late Pliocene and Pleistocene environments is often considered as critical for reconstructing the impacts of environmental changes influencing the selection pressures on-human populations, to the extent that some scholars would interpret them as the primary cause for the success or failure of different human species. The assumption is that humans, like other mammals, were adapted to a particular environment and when they moved to a new region, either by choice or in need to search for food, they would prefer to exploit an environment that resembled their original homeland. This could have happened in some cases, but from the Lower Pleistocene onwards hominins have migrated into new environments that challenged their survival, with the outcome that some populations succeeded while others failed and became extinct. In the course of this process of adaptation to new habitats we note that human fossils, such as the cluster of skulls at Dmanisi (Lordkipanidze *et al.* 2013), reflect an extended range of morphological variability that possibly shows a degree of interbreeding among various hominin groups.

Reiterating this issue we stressed elsewhere (Bar-Yosef, Belmaker 2011: 1318) that "it has been suggested that the Early Pleistocene expansion of savanna environments into Eurasia allowed for the first 'Out of Africa' dispersal (Dennell 2004, Martínez-Navarro 2004). In particular, the colonization by humans of Western Europe is generally attributed to the major role of warmer periods and much less to cultural capabilities (Agustí *et al.* 2009)". The indication that refutes these proposals is the site of Dmanisi, dated to 1.85–1.77 Ma, where hominins produced a "core and flake industry" (Ferring *et al.* 2011 and references therein). The suite of mammalian fauna and the pollen records indicate a forested area with *Abies*, *Pinus*, *Fagus*, *Alnus*, *Castanea*, *Tilia*, *Betula*, *Caprinus* and rarely *Ulmus* and *Salix*, as well as bushes and shrubs and herbaceous association dominated by Cyperaceae, Germineae and Polygonaceae. Thus the cumulative information is consistent with humid warm-loving broad-leaf forest, similar to today's environment of the western Caucasus and very different from hominin homelands in the African savanna (Bar-Yosef, Belmaker 2011: 1329 and references therein).

To cite a similar conclusion concerning Middle Pleistocene sites in Shaanxi Province, the investigators note that "hominins initially occupied the Luonan Basin by at least 0.8–0.7 Ma… [and] it appears that they exploited this area … [also] by 0.4–0.3 and 0.2–0.1 Ma. The hominins were attracted to the subtropical and warm-temperate climate at this time, where they exploited prey animals within broad-leaf forests, with an understory of grasses. Clearly these early humans … at similar times as those … at the 0.5 Ma site of Boxgrove and the 0.4 Ma Schöningen site … were able to occupy a range of environments, using a variety of stone technology" (Lu *et al.* 2011). Therefore modeling the foresights of migrating hominins and concluding what would determine their choices misses the point of what is needed – field research. Only palaeo-ecological and archaeological data sets can tell us about hominins successful or failed decisions, not theoretical models built on assumptions derived from current human behavior.

Recently J. J. Hublin (2014: 1339) expressed the view that is held by most researchers of the Palaeolithic period and stated that "the Palaeolithic archaeological record can yield a wealth of information regarding stone technologies or food procurement, but remains mute on key aspects of human behaviors, such as mating strategies, aggression, or large-scale cooperation". True, but we do know more than just about the Palaeolithic stone tools *per se*. Two of the behaviors mentioned above were essential for the success of hominin evolution and migrations into different environments namely, cooperation and mating behavior. Without cooperation and social interactions and interbreeding within human groups, ("tribes") of 500–800 people (Birdsell 1973, 1985), they could not survive biologically as a viable population. Total fertility rates of females is a key issue, and studies of hunter-gatherers indicate how many living offspring between the ages of about 19 through 30/32 a woman in a mobile society can produce, from which we can derive the resulting survival probability of males and females (e.g., Hawkes 2010, Hawkes, Paine 2006 and chapters therein, Sørensen 2011) and so model the persistence or otherwise of Pleistocene bands. For colonizing hominins and their descendants who became locals after a generation or two, new environments were a challenge but not severely detrimental to their survival. As long as the newly invaded areas were not disease-infested human social ingenuity allowed them to survive (Bar-Yosef, Belfer-Cohen 2001, 2013 and references therein). Therefore we have to conclude that during the Lower Palaeolithic altruistic behavior evolved as well the social mechanisms to restrain "free-riders" among foragers, whilst accepting the proviso that these mechanisms did not work all the time and everywhere. Under conditions of abrupt climatic change mistakes made by groups of hominins could have been biologically disastrous. Thus the behavior of natural leaders, such as the best hunters in temporary or semi-stable bands, would determine the fate of others. However, demonstrating the evolution of these social traits among early hominin societies is difficult and is probably expressed in chronological hiatuses in various geographic regions. Yet, once we reach the interpretation of Middle Palaeolithic sites, instances of the variable treatment of individuals by other members of a given band are evident, although the degree of compassion underlying the evidence is debated – as at Shanidar cave (e.g., Dettwyler 1991, Silk 1992, Trinkaus, Zimmerman 1982). A different treatment is recorded in Marillac cave that indicates feasting on human cadavers (e.g., Garralda *et al.* 2014).

Facing new environments did not cause hominins to change their habitual ways of making stone tools. Numerous examples can be cited for the guarding of the traditions of making stone objects (to be discussed below), and other tools and objects shaped from organic substances such as wood, bamboo, flax, etc. that unfortunately are rarely preserved (e.g., the spears of Schöningen). A good example of long term tradition is the Acheulian Complex and its continental distributions, using the same basic bifacial technique for shaping handaxes and large flake cleavers. Thus the Acheulian bifacial technique for fabricating particular tools, spread over a wide range of environments and climates and survived through hundreds of thousands of years. True, this is hard for us to explain although some Middle Palaeolithic sites provide examples of long-lasting traditions. For example, the Early Mousterian in the Levant ("Tabun-D-type" or Abu Zifian) lasted from *ca.* 220 to 140 ka, about 80,000 years or about 4000 generations, each of 20 years (Bar-Yosef 1998). For our modern mind it is easier to consider relatively short terms of just a few thousands of years. Examples are numerous and include the Châtelperronian, Aurignacian, Solutrean, Magdalenian, Bohunician, Ahmarain, Kebaran, Natufian and many others, dated to the time ranges of the Upper Palaeolithic or the Epi-Palaeolithic of Europe and Western Asia.

The schematic chronological chart in *Figure 2* compares what we know at the time of writing about Mainland China. The long persistence of some Chinese traditions undoubtedly raises the question of "why?". Low demographic densities as sometimes suggested are based on poor knowledge by western-based researchers who are not familiar with the extensive collections stored in Provincial Institutes of Archaeology and Cultural Relics, Work Stations of these institutions, or the Institute of Vertebrate Palaeontology and Palaeoanthropology of the Academia Sinica. *Figure 3* is only an example for the intensive and extensive research conducted in a small area in China demonstrating the distribution of Acheulian open-air sites (Dennell 2009, Lu *et al.* 2011, Wang S.-J. 2005, Wang, Huang 2002, Wang *et al.* 2012, Wang *et al.* 2013). The rapid modern development of China, involving activities such as building roads, dams, and large installations in the last two decades has uncovered many sites buried in alluvial and loessial deposits across the Chinese mainland. The publication of those recent investigations will undoubtedly change the preliminary view of past cultures presented in *Figure 2*.

STONE INDUSTRIES AND HUMAN BEHAVIOR

Since the early days of Palaeolithic research sites and assemblages of stone artifacts have been classified as "industries" according to typical tool types (*fossiles directeurs*) together with the most basic knapping techniques. Industries were named after the first site where they were uncovered such as Acheulian (St. Acheul in northern France), Mousterian (Le Moustier rockshelter in southwest France), and many more. The Chinese archaeologists follow the same rule.

Recognition that the details of knapping techniques, known as "operational sequences" (*chaînes opératoires*) also labeled as "reduction sequences", can provide clues for identifying the "people with no name" in the past, resulted in a rapid increase in the number of studies aiming to demonstrate the uniqueness of particular lithic industries from tool stone collection, production, use and discard. This kind of analytical method assists us in relating lithic assemblages to particular prehistoric groups or populations (e.g., Bar-Yosef, Van Peer 2009 and references therein, Boëda 1995, Boëda *et al.* 1990, Lemonnier 1992). We interpret this information as flagging the tradition of teaching and learning processes

Dates BP	West	North	Central	South	SW ASIA
		West *East*	*North* *South*		
8,000		**Neolithic**	**Neolithic**	**Neolithic**	
	Microblades				
10,000		Donghulin			**Neolithic**
12,000			Shizitan 9 Dagang Lijiago u	**Cobble tools**	**Epi-Paleolithic** Microlithic industries
15,000	**Core & Flake**	Hutouliang (Microblades) Erdaoliang(Micro)		Shell tools Bone tools **Cobble tools**	
20,000		Mengjiaquan *Wang Fujing* *Upper cave* *Zhoukoudian*	Xiachuan(Late) Xiachuan(Early) Shizitan 14, 29	*Yuchanyan*	
25,000	OES beads SDG 7 **Core & flake**	**Small flake** **Microblades** *Youfang* (Blade/Micro)	Xishi Longwangchan **Microblades**	**Small flake industry**	**Upper Paleolithic** blade indust.
30,000	SDG Blades Levallois artifacts	**Mousterian**			
		Core & Flake			
50,000	**Core & Flake**	Discoidal cores (Middle Paleo) Xujiayao	**Core & Flake**	**Cobble tools**	
100,000 130,000	*Dadong Cave*	*Zhoukoudian 15*	**Acheulian** (*Luonan Basin*)	?	*Tabun B-type* *Tabun C-Type* **Mousterian** *Tabun D-Type*
250,000		**Core & Flake** *Zhouk.Loc.1.layer 4*	**Core & Flake** (*Longyadong*)	?	Acheulo-Yabrudian *Qesem cave* *Tabun cave E*
400,000					
500,000	?			**Acheulian** Guangxi Province ?	Late Acheulian
	?	*Zhouk Loc.1.layer 10*	**Core & Flake** ?		
800,000		**Core & Flake**			*Gesher Benot* *Yaaqov*
1.000,000				**Core &** **Flake**	**Early** **Acheulian** *Latamne*
1,500,000			*Lantian* 1,600 000		*'Ubeidiya*
2.000,000		*Nihewan* 1,660,000			*Damanisi* Core &Flake 1,800,000

FIGURE 2. Chronological table of the Palaeolithic entities of China according to sub-regions divided according to the west-east axis as well as north-south. Only a few known sites are incorporated based on current literature (e.g., Bar-Yosef, Wang 2012, Gao 2013, Qu *et al.* 2013). Question marks denote the lack of sound chronology and uncertainties in cultural continuities.

among past societies that often lasted through many generations.

Teaching begins with children and is assisted by language and observations. The combination of imitation and explanations achieves the best results. We should remember that many microwear and edge damage analyses have verified that the same tasks can be done by stone objects obtained by different operational sequences and bearing variable morphologies (e.g., Beyries 1988, Beyries, Plisson 1998). This observation is similar to the variability between Chinese, Korean and Japanese chopsticks. The first are made of bamboo or wood and are long and rounded. The second are long, made of metal, with a relatively flat cross section. The third, the Japanese, are shorter than the other two but have very sharp and pointed edges. However, all are employed in the eating of well-chopped food. Needless to say children are trained from an early age to eat with chopsticks, using a shorter version than those used by adults. The teaching procedures are accompanied by physical gestures and linguistic explanations. No wonder then that adults, after spending time in foreign countries when returning to their homeland will continue to use chopsticks as they speak their maternal language.

However, so far as early hominins are concerned, dating the emergence and role of language continues to be unresolved. Some workers consider that *Homo erectus* was already capable of speech while others prefer to see it as emerging later during the Middle Pleistocene. I therefore leave this question as an option for continuing discussion.

The African and western Eurasian sequences indicate that the earliest industries were based on "core and flake" techniques known as the Oldowan (e.g., Hovers, Braun 2009), that were often replaced by Acheulian handaxe (biface) assemblages about 1–1.5 Ma. This shift did not happen in China where the general type of "core and flake" industries survived for a very long time (e.g., *Figure 2*) (Bar-Yosef, Wang 2012, Gao 2012, 2013). In various areas of western Eurasia the Acheulian contexts are interspersed with "core and flake" industries labeled as "Clactonian, Tayacian, etc." This phenomenon may have happened also in China but further advance in the dating of recorded sites with crude bifaces are required before such an intermittent sequence of cultural change can be confirmed. As reported, most Acheulian sites and isolated finds have been located and excavated in South China (Hou *et al.* 2000, Petraglia, Shipton 2008, Schick 1994, Schick, Zhuan 1993, Wang S.-J. 2005, Xie, Bodin 2007). Especially well-known are the Bose localities along the Yang River, in Province, where Acheulian handaxes are often accompanied by cores and flakes and

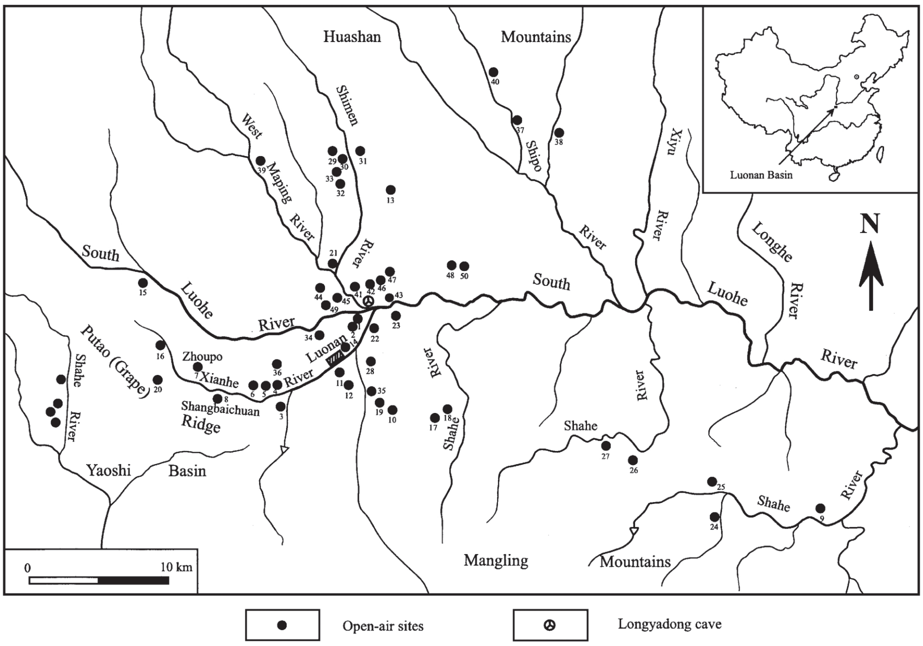

FIGURE 3. The distribution of the Acheulian occurrences in the Luonan basin. After Wang, Huang (2002).

are associated with tektites that are dated to ca. 800,000 years ago. However, these dates are still controversial.

The Luonan basin in Shaanxi Province (*Figures 1, 3*) and adjacent valleys produced similar contexts of Acheulian handaxes, picks and spheroids dated to approximately 250–50,000 years ago (*Figure 2*). The particular character of the Chinese handaxes is that they are bifacially shaped by a few removals, although the trihedrals demonstrate additional flaking. Western scholars debated for over half a century the issue of "design" (e.g., Isaac 1969, Gowlett 2006). As they noted, the identification of sub-types is imposed by the modern mind, but detailed analysis may disclose the structure of this variability that can then serve for inter-site comparisons. As long as we agree that the definition of this industry is based on the presence of variable frequencies of handaxes and cleavers we can accept that the simple rudimentary shapes of the recorded Chinese examples (e.g., Wang S.-J. 2005, Wang *et al.* 2012) indicate, as suggested by Gao (2012, 2013), that they served as expedient tools. This conclusion finds support in the ephemeral presence of handaxes over the landscape known as the "Scatters-between-the-patches", a term proposed by Isaac and Harris (1975) to describe the low-density distributions of artifacts between the rich density patches of the Lower Pleistocene record in East Africa. The study of this phenomenon was conducted by Stern (1993) who demonstrated how such finds are an integral component of the sequence that relies only on the "patches", i.e., the sites.

A similar phenomenon was first recognized by Prof. J. Yuan (former director of the Provincial Institute of Archaeology of Hunan) who collected isolated handaxes in brickyards, where quarried clay is sieved and all the rocks are dumped. A brief visit and quick sorting of these dumps results in finding large flakes and rare spheroids and handaxes. Therefore these bifacially shaped objects differ from those well-shaped African and Eurasian handaxes that were carried around and could be used as cores for the detachment of sharp flakes when needed (Jones 1980, McPherron 2006). However, they do not differ from the finished bifacial objects that probably were used with minimal reshaping, for butchering, bamboo cutting, bark removal and other purposes. Moreover, in the majority of cases the Chinese items do not exhibit the careful shaping that resulted in advanced symmetry, as do numerous examples of Upper Acheulian age across western Eurasia and Africa (e.g., Wynn 2000).

At that point we need to briefly mention the "Movius line" that marked the absence of the Acheulian complex in East Asia. This conclusion emerged from the writings of H. L. Movius who originally conducted fieldwork in Burma and Java. He noted the presence of core and flake industries in China-Southeast Asia and the absence of handaxes although rare surface finds indicated otherwise. His map of the Old World distribution of core and flake versus handaxe industries resulted in the formation of the "Movius line" (Movius 1944: 409, Map 4). Further research demonstrated the presence of bifacial artifacts in China (e.g., Bar-Yosef, Wang 2012, Hou *et al.* 2000, Petraglia, Shipton 2008, Schick 1994, Wang S.-J. 2005, Xie, Bodin 2007). Although old terminologies die hard, this term may finally be about to disappear from the literature.

Searching for what could be called Middle Palaeolithic in China is not an easy task because it requires finding similar assemblages to those incorporated in the definition of this term in western Eurasia, or within the Middle Stone Age in Africa (Gao 2013, Yee 2012). In both continents these industries have received a lot of attention during the last 150–100 years. Recently the adoption of the "operational sequence" concept and its implications has focused on the "flaking systems" (e.g., Boëda 1995, Boëda *et al.* 1990) as well as on other techniques known as "Middle Palaeolithic laminar flaking", "discoidal and denticulate", "Quina flaking system" and "Mousterian of Acheulian Tradition". The desired or used tools could either be plain or retouched (e.g., Delagnes, Rendu 2011).

Practicing the Levallois techniques require more experience in knapping to detach the desired, predetermined, products than most other Lower and Middle Palaeolithic industries, especially when compared to "core and flake", Acheulian handaxes and even several blade operational sequences. Claims that the different Levallois methods could be learned by imitation through observation without linguistic explanations appear as a possible option in principle. However, as long as this proposal is not tested, or tested but not reported, I personally refuse to accept it. When one asks an experienced flint knapper how much time it takes to reach the level of skill of producing Levallois products, such as we find, for example, in the Levant or northern France, the answer would be "no less than a year during which daily practice is essential" (e.g., Eren *et al.* 2011).

The products of this suite of techniques, although related to each other, can be made on most available raw materials. However, the generally absence of Levallois products in Mainland China means that those who were trained in making them never reached the vast plains.

A clear example for this claim is presented elsewhere (Bar-Yosef *et al.* 2012) where selected river cobbles in western Hunan Province were shaped into typical Levallois cores (see M. I. Eren in Bar-Yosef *et al.* 2012: 13, Fig. 6). This knapping technique is well represented in the northern latitudes in the Altai Mountains, and east of the Baikal Lake in Siberia. Within China Levallois products were recorded in Jinsitai cave, on the border between Inner Mongolia and Jilin Province, and further west in Shuidonggou 2 on the Yellow River in Ningxia, in western China, (e.g., Boëda *et al.* 2013, Li *et al.* 2013, Qu *et al.* 2013) (see *Figure 2*). In the latter site this industry was dated to ca. 38–34 ka cal BP and was replaced by makers of "core and flake" assemblages.

These observations support the notion that the use of the basic core reduction technique generally has nothing to do with the presence or lack of appropriate raw material. Various studies show that modern foragers are fully knowledgeable concerning the availability of hard rocks for making stone tools in their environment. Thus, those who practice the Levallois technique, that seems to require relatively large nodules, may also inhabit an area where only pebbles are available, so that the Levallois cores and products are much smaller than elsewhere, but they were evidently produced by this technique. Such is the case of the Pontinian Mousterian in Italy (e.g., Grimaldi, Lemorini 1995, Kuhn 1995). A detailed experimental study concerning the role of raw material concludes that "an assumed preeminence for raw material 'constraints' cannot be justified" (Eren *et al.* 2014: 486).

MICROBLADES, COBBLE-TOOLS AND POTTERY

"Microliths" – small objects produced on small flakes and bladelets, and shaped by secondary retouch to be hafted – were noted from the late 19th century and were generally attributed to the Mesolithic period. The definition of the bladelets as differentiated from blades became a matter of preference according to different schools of archaeology. In southwestern Asia the metrical boundaries suggested by J. Tixier (1963) for North Africa were adopted together with the term Epi-Palaeolithic. Blades are larger than bladelets, the width of which is up to ca. 12 mm. When modified by retouch and named "microliths" their width is below ca. 9 mm; their length in all cases has no metrical limits. Thus, for example, Chinese microblades should be defined as bladelets and could be up to 40–60 mm long and are generally less than 10 mm wide (e.g., Chen 1984, 2007, Chen, Wang 1989, Lu 1998, Keates 2007). The observation that should be stressed here is that most bladelets in the Chinese microblade assemblages are not retouched. This is the characteristic trait that differentiates them from the western Eurasian assemblages where microliths, by definition, are retouched. Their use, as demonstrated by a few well-preserved objects, was to haft segments of microblades in bone handle (Cui 2010, Lu 1998).

In recording tool production, the operational sequences of the reported assemblages in China from ca. 29/27 ka cal BP (Nian *et al.* 2014, Shizitan Archaeological Team 2013, Zhang *et al.* 2011) follow the studies initiated by Morlan (1967) in Japan, and are presented in various papers (Chen 2007, Keates 2007, Kuzmin *et al.* 2007 and papers therein). It should be noted that Japanese reports are based on painstakingly refitting flakes and the detailed description of reduction sequences which is yet not the case in China (e.g., Bleed 2002 and references therein, Sato, Tsutsumi 2007). Given good quality raw material, that was sometimes heat-treated, the detaching of these razor sharp bladelets was done by direct or indirect percussion or by pressure flaking (e.g., Flenniken 1987, Morlan 1967). The main core types are designated by their morphology and scar pattern recorded in their exhaustion stage. Careful examination reveals their pretreatment prior to detachment of the bladelets. The accepted typology for micro-cores in Chinese studies follow the early European view of Upper Palaeolithic prismatic cores when the striking platform is up. The recorded types include "wedge-shaped", "boat shaped", "conical", "funnel-shaped" "semi-circular", and "pencil shaped" (e.g., Chen 2007). Detachment was done by direct and indirect percussion and the last type – by pressure flaking. Differences in the labeling of core types represent the dominant terminological traditions established by "schools of archaeology" in conducting research on stone tools. Thus, in western Eurasia "boat-shaped" and "wedge shaped" cores are called "carinated" cores following the French terminology of *rabot* (push-plane) when the core is placed with the striking platform down and the crested ridge up. An interesting example is that "pencil-shaped" cores are known as "bullet cores" by Near Eastern archaeologists probably reflecting the lack of security in these countries.

Once incorporated in a well-established chronological scheme, we can propose questions concerning the origins of the microblade industries of northeastern Asia, in particular concerning the learning systems and their social contexts, and the transmission of information and knowledge, as well as the processes of acculturation through geographic dispersals. Interestingly, although good raw material for making microblades can be found in south China in various provinces, there is no hard evidence that the bladelet makers ever moved beyond the Qingling Mountains (*Figure 4*), which are considered as the major geographic and climatic boundary between north and south. Thus one may wonder what motivated the bearers of the microblades to disperse and reach by migration northeast Asia and further on to North America (Qu *et al.* 2013).

The changes in the south were in a different technological direction, by replacing the core and flake technique with "cobble tool" assemblages. The cobbles, although used before, were collected from rivers' banks. This industry, derived from stratified caves, dominates the period from ca. 24/22 ka cal BP through the Terminal Pleistocene. Assemblages of "cobble tools" included one-side choppers, heavy duty scrapers and flakes, as well as bone and antler tools and shell tools are also known (Qu *et al.* 2013). Surface assemblages of "cobble tools" might well first be attributed to Lower or Middle Pleistocene sites. Thus, without excavations and radiometric dating the age of such collections cannot be determined.

In an overview of Southeast Asia it seems that the Chinese cobble tool industry is directly related to the vast area where bamboo grew even during the Pleistocene (e.g., Bar-Yosef, Wang 2012, White 2011). In southeast Asia archaeologists refer to a variant of this industry as the Hoabinhian culture (e.g., Forestier 2000, Zeitoun *et al.* 2012). A series of experiments conducted by us in Hunan Province demonstrated that one side chopper and flakes are sufficient for making various objects from bamboo (Bar-Yosef *et al.* 2012). Thus, in the context of hunting and gathering societies a simple stone tool-kit was sufficient for producing many different objects and tools from organic materials such as wood and bamboo. Through time the makers added the use of antlers and bones as raw material, as well as large *Unio* sp. shells.

An important point that should be stressed concerning the use of raw material is that flint or other siliceous sources are available not only near and north of the Yellow River, but these also occur south of the Yangtze River. But no microblades assemblages have been reported from the south. This can only mean that it is not the availability of appropriate raw material that prevented the making of microblades. Rather, it is that the people of the north never moved south but instead spread into northeast Asia, later moving to North America. Thus, the making of stone artifacts is hardly related to the available raw materials in the environment; instead it is all a matter of cultural learning. We can thus reiterate the notion that the operational sequences represent the "people with no name".

In addition, several groups in south China since 20/19 ka cal BP made an important addition to their food processing activities by making pottery (e.g., Cohen 2011 and references therein, Wu *et al.* 2012). The presence of early pots of Upper Palaeolithic age, also reported from the Japanese archipelago and eastern Siberia, demonstrates that this invention, whether starting in one locality and subsequently spreading, or originating independently in different centers, does not fit with Childe's definition of the Neolithic Revolution.

PROBLEMS WITH ACCEPTED INTERPRETATIONS

Interpreting the known Palaeolithic knapping techniques, assemblage compositions and tool types in the western Old World is not exclusively the domain of archaeologists. Others, experts in fields of cognitive science, psychology, linguistics, philosophy and more, employ the reports produced by archaeologists over many decades to propose new interpretations. The classified objects collected in the course of surveys and excavations (e.g., lithics, bone, antler, ivory objects as well as body decorations) became sources for varied interpretations. Scholars who are interested in the evolution of human patterns of behavior and cognition, particularly of what is still referred to as "modern behavior", are engaged in lively discussions (e.g., Shea 2011, Wynn, Coolidge 2011). For demonstrating that "modern behavior" prevailed lithic assemblages must be dominated by blade production and accompanied by bone/antler objects and body decorations generally dated to the Upper Palaeolithic period. Moreover, rock art, intra-cave murals and open-air site engravings, as well as mobile imagery (e.g., figurines), are considered as expressions of distinguished Palaeolithic artisans apparently with minds that exemplify their closeness to ourselves, modern *Homo sapiens*. All these expressions are interpreted as reflecting the presence of language and symbolic behavior, and are currently incorporated within the hypothesis of *enhanced working memory* (Wynn, Coolidge 2011 and references therein).

Assumptions concerning the late emergence of the Upper Palaeolithic trait complex depend on the dating of the archaeological markers (use of pigments, shell beads,

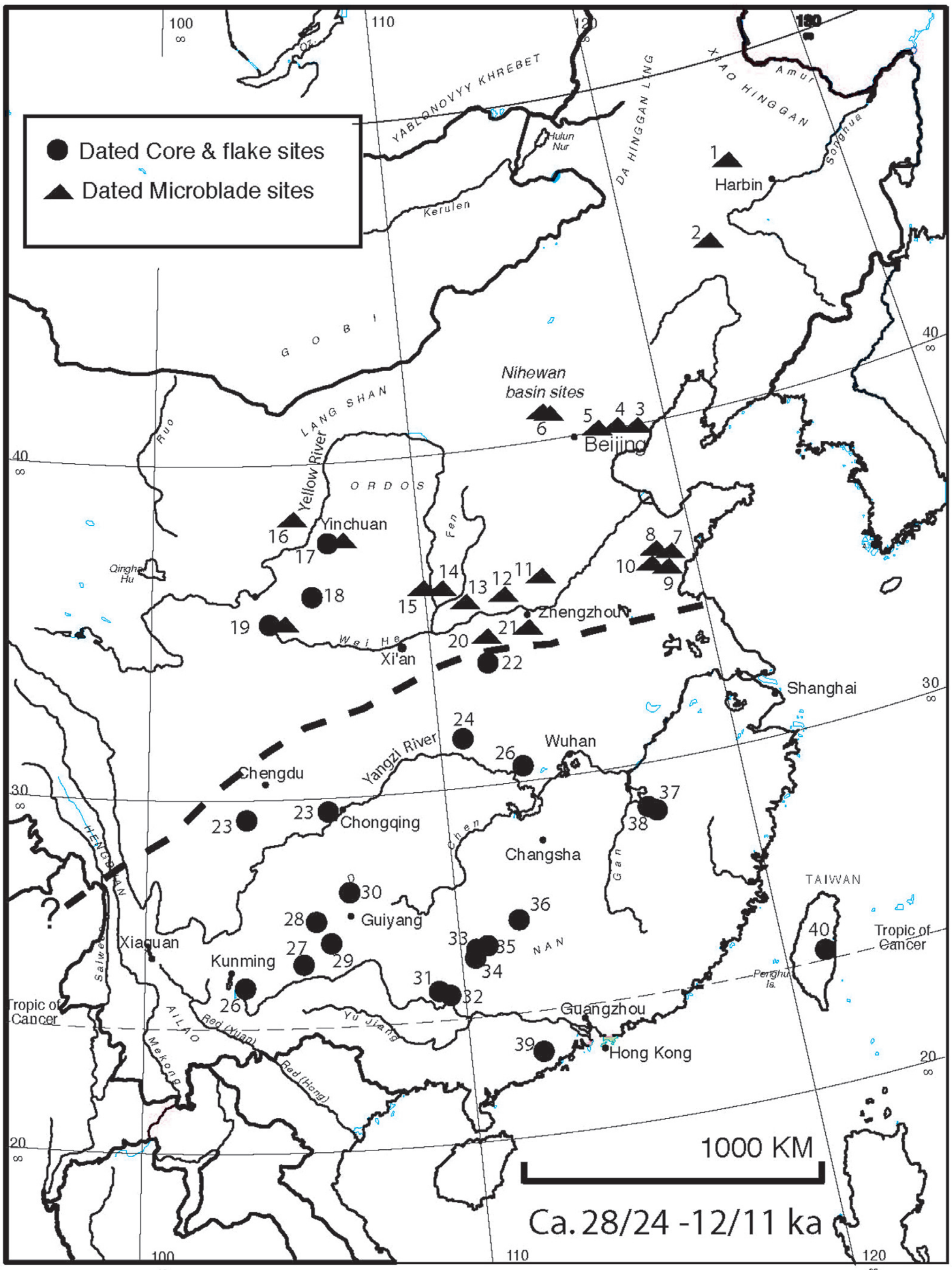

FIGURE 4. Distribution of dated microblade sites in China (after Qu *et al.* 2013 with additional modifications). The dashed line marks their southern distribution across the country. The dated sites of both industries (microblades and core and flake including cobble tools) are: 1, Daxingtun; 2, Dabusu; 3, Tingsijian; 4, Donghuishan; 5, Mengjiaquan; 6, Nihewan sites (Hotouliang, Youfang, etc.); 7, Qingfengling; 8, Fenghuangling; 9, Wanghailou; 10, Heilongtan; 11, Xiaonanhai; 12, Xiachuan (upper layer); 13, Xueguan; 14, Shizitan; 15, Longwangchan; 16, Pigeon Mtn; 17, Shuidonggou SDG.12; 18, ZL05; 19, Dadiwan (stratified core and flake and microblades); 20, Dagang; 21, Lijiagou: 22, Xiaokongshan; 23, Fulin; 24, Tongliang; 25, Zhangnaodong; 26, Jigongshan (upper layer); 27, Longtanshan; 28, Maomaodong; 29, Chuandong; 30,Baiyanjiaodong; 31, Ma'anshan; 32, Bailiandong (middle and upper layers); 33, Liyuzui; 34, Zengpiyan; 35, Miaoyan; 36, Yuachanyan 37, Xianrendong; 38, Diaotonghuan; 39, Dushizai; 40, Baxiandong.

elaborate bone tools, the making of blades, and more). Most of these have been shown to have an older age in both Africa and Western Asia (e.g., Bar-Yosef, Kuhn 1999, Bar-Yosef Mayer *et al.* 2009, Belfer-Cohen, Hovers 2010, Bouzouggar *et al.* 2007, McBrearty, Brooks 2000) and do not necessarily coincide with the dispersals of modern humans into Eurasia some 60/55–45 ka BP.

However, more intriguing are the arguments and interpretations suggested by non-archaeologists, and as discussed here on the basis of a small selection of citations. For example Beaman writes (2010: S36) that "to be fair, anthropologists recognize the difficulties of inferring cognitive capabilities and process from *inanimate artifacts*, and fossils and other methods, such as comparative studies of nonhuman primate behavior" (italics are mine). This expression stands in contrast to the reasoning noted above concerning teaching and learning in producing stone artifacts among foragers' societies.

Another scholar suggests that "moreover, it is doubtful that early hominins possessed a conceptual understanding of simple Oldowan edges as 'tools' (as opposed to merely bodily extensions for achieving certain ends). In all likelihood, the conceptual category 'tools' did not emerge until the advent of the Acheulean handaxe" (Rossano 2010: S91). In this case a brief examination of *Figure 2* indicates that early Upper Palaeolithic humans in China, such as those who occupied Shuidonggou 7 (Ningxia) and who made ostrich eggshell beads (27–25 ka cal BP), used cores and flakes similar to the Oldowan. Similar context of lithics and body decorations was uncovered in Upper Cave Zhoukoudian (Qu *et al.* 2013). Does this means that they did not have the concept of a "tool"?

However, the same author (Rossano 2010: S92) used Chase's analysis (1991) following Sackett's papers on "style" (Sackett 1982, 1986) to justify the definition of a "prehistoric culture", as used in this paper and elsewhere, by stating that "if one group traditionally creates stools with three legs and another with four, then the number of legs on the remains of stools serves as a reliable indicator of a particular group". So "tribes" of foragers did exist.

In general Foley (1996) suggested that evolution of human cognition must be based on the palaeobiologically of hominins evolution. Cultural differences could be "far greater than differences in biologically based cognitive skills" (Mellars 1996: 43). This is probably true, but how do we measure differences in biologically based cognitive skills to the exclusion of culturally determined ones? If the so-called "anatomically modern humans" were essentially the same all over the Old World, at least from some 60–50,000 years ago, then the observed differences in their tool-kits characterize their particular nature as "prehistoric cultures". The same observation can be made in view of the variability among "prehistoric industries" incorporated within the Middle Palaeolithic period whether we deal with the Neanderthals or their contemporaries in Africa. However, as we are generally limited to the stone tools, and only rarely recover remains that may tell us about other human skills and knowledge and thus about their cognitive level, we should be very careful in drawing conclusions. In several cases due to good preservation we are informed about the use of bitumen as hafting material for points and knives during the Middle Palaeolithic in the Levant (e.g., Boëda *et al.* 1996). Analysis of residues and micro wear analysis reveals a different hafting technique in South Africa (Lombard 2005), as well as additional innovative technological solutions (Wadley 2010).

In sum, the original cultural expression in hominin evolution is the Oldowan and similar "core and flake" industries across Eurasia. In Africa and western Eurasia most of these industries were replaced by a second technical step – the Acheulian, nearly 1.7–1.5 Ma ago. Within the given geographic limits the "archaeological evidence from stone tools (handaxes, to be precise) suggests that an ability to coordinate visual and spatial information was in place by 1.5 million years ago (Wynn 2002) which in turn suggests that this piece of working memory may in fact be older than the phonological components." (Wynn, Coolidge 2010: S10). Does this means that the people of mainland China acquired the ability to coordinate visual and spatial information only by 0.8 Ma ago, if we accept the earlier date for the Acheulian in Bose, Guangxi (south China)? If this date is mistaken, as suspected by several scholars, then this capacity only emerged by 0.25 Ma ago (*Figure 2*). The worst option is that those who did not adopt the making of Acheulian handaxes in other provinces of China remained until some 30,000 years ago in the primary state of cognitive evolution, makers of core and flake industries, lacking perhaps enhanced working memory (Wynn, Coolidge 2010).

At this point citation of a reasonable interpretation of the cognitive changes that occurred during the course of human evolution is in order. A summary of human capacities stresses that "inventiveness *per se* is part of primate cognition in general and of humans in particular. Thus, it seems that the visibility and frequencies of the so-called modern features in the archaeological record reflect not only the internal mental capacities involved but also, or even mainly, the external circumstances in any specific instance. It is only under favorable conditions that social groups can afford to check out those inventions and select and retain the advantageous ones" (Belfer-Cohen, Hovers 2010: S170). This proposition is not limited to modern humans but to those producing all "modern features" as suggested in the seminal paper by McBrearty and Brooks (2000). It may also assist us in understanding why changes in the production of stone tools in Mainland China took longer to occur there than in other geographic regions.

In this context one may well ask why a selected set of kitchen and carpentry tools made of stones are supposed to reflect the evolution of the mind? Stone tools as mentioned above were used, based on replications and microscopic analysis, for cutting, whittling, butchering, scraping (including hides), splitting bamboo, shaping wooden tools, preparing fibers as strings and much more. Thus the assumption that stone artifacts used for particular activities, including the production of composite tools, can be direct indicators of cognitive level, without witnessing the richness of the organic products incorporated in those tools and which in some cases required complicated operational sequences to achieve them, is simply wrong. As demonstrated by several investigators (e.g., Haidle 2010 and references therein, Wynn, Coolidge 2011), only organic objects used for hunting, shaping wooden and bamboo tools, clothing, strings, etc.) should signify the evolution of the human mind. The rare preservation of such objects, including their microscopic residues, warns us that in spite of our efforts we are still a far cry from really understanding the minds of the makers of the Palaeolithic records.

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