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A macroscopic technological perspective on lithic production from the Early to Late Pleistocene in the Hanshui River Valley, central China

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ABSTRACT

The nature and variability of Chinese Paleolithic culture remain unclear because the method of studying lithic industries has been essentially typological, and few regions have been intensively researched. A technological and techno-functional methodology provides a new perspective for exploring the cognitive modes of hominids and interpreting the intra and inter-regional homogeneity and variability of Paleolithic cultures. Over the last few decades, numerous Paleolithic sites with stone artifacts were excavated in the Hanshui River Valley. Based on a new methodology and recent discoveries, this paper reviews the Paleolithic sites of the Hanshui River Valley and studies representative industries to investigate regional lithic production and human behaviors. In terms of operative schemes, *débitage* and *façonnage* coexisted at nearly all sites and showed continuity and stability throughout the Pleistocene. For *débitage*, the Type C was present in nearly all sites. For *façonnage*, operative scheme 1 (unifacially-knapped on matrix of simple bevel) was predominant. The operative schemes of both *débitage* and *façonnage* were extremely similar in that great emphasis was placed on the selection of natural technical characters rather than on intentional preparation. For inter-regional variability, the percentage of bifaces was much lower (<5%) than in Acheulean Complex and the operative schemes for producing these tools were different from those of Acheulean bifaces, which suggested a clear distinction of techno-cognitive modes between hominids of the Hanshui River Valley and those of the West. Regarding intra-regional variability, the technological and techno-functional method provides a new perspective for interpreting the variability of hominids' techno-cognitive modes during lithic production. More extensive dating analysis would enable the construction of a more detailed chronological sequence of the Hanshui River Valley.

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1. Introduction

Although there are debates about the earliest dispersals of hominids from Africa to East Asia (Bar-Yosef and Belfer-Cohen, 2001; Mithen and Reed, 2002; Antón et al., 2002; Antón and Swisher, 2004; Norton and Braun, 2010; but see Dennell and Roebroeks, 2005 for a different view), several discoveries have clearly confirmed that hominids could have occupied East Asia during an early part of the Early Pleistocene (Zhang et al., 2000; Zhu et al., 2004; Boëda and Hou, 2011). The past few decades have seen a great increase in the amount of Paleolithic evidence including human and other mammalian fossils, and especially stone artifacts throughout China, making it a key area for the study of human evolution in East Asia during the Pleistocene.

Since the discovery of the Zhoukoudian site in the 1920s (Pei, 1929; Black et al., 1933), the nature and characteristics of Chinese Paleolithic cultures have received much attention. Based on Hallam Movius' observation that "*the most salient feature characterizing the Lower Paleolithic culture complex of eastern Asia was the absence of handaxes and Levallois industries and a low degree of standardization of stone artifacts, as much as it is the presence of choppers and chopping-tools*" (Movius, 1949, p.72), a technological and geographic division between East and West was later summarized as the "Movius Line" (Swartz, 1980). There are two contrasting opinions on this technological dichotomy: on one hand, some maintain that Chinese Paleolithic cultures were remarkably

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different from those of the western Old World and did not develop during the Lower and Middle Paleolithic (Schick and Dong, 1993; Gao and Norton, 2002; Boëda, 2004; Norton et al., 2006; Norton and Bae, 2008; Lycett and Bae, 2010; Lycett and Norton, 2010, among many others), which to some extent confirms the validity of "Movius Line" *sensu lato* (Norton et al., 2006). On the other hand, others dispute the validity of the "Movius Line" *sensu stricto* and focus on three aspects: firstly, some researchers have explored the environmental rather than cognitive reasons why such differences occurred (Bordes, 1978; Schick, 1994; Clark, 1998; Leng and Shannon, 2000; Keates, 2002; Dennell, 2003, among many others); secondly, on the basis of the discovery of bifaces in East Asia, a few researchers have questioned the validity of "Movius Line" *sensu stricto* and suggested that there was cultural uniformity between East and West (Huang, 1989; Huang et al., 2009); and thirdly, some researchers have criticized the "Movius Line" for ignoring the variability of Asian Paleolithic industries (Ikawa-Smith, 1978; Leng and Shannon, 2000; Keates, 2002). As a result of heated controversy, the "Movius Line *sensu stricto*" has been largely discarded (Schick, 1994; Leng, 1998; Norton and Bae, 2008; Lycett and Norton, 2010). In China, much attention has also been attached to the variability within Paleolithic cultures, which was summarized as "two traditions in the North" (i.e. "Kehe-Dingcun" represented by choppers on large flake and big trihedral picks, and "Zhoukoudian locality 1-Shiyu" represented by bilge-formed scrapers and burins) (Jia et al., 1972) and "two traditions in the whole China" (i.e. a Flake Tool tradition in North China and a Pebble Tool tradition in South China) (Wang, 1998; Zhang, 2002).

In term of methodology, the "two traditions in North China" and "two traditions in the whole of China" were both summarized on the basis of typological criteria including size, weight, morphology, thickness, or the type of retouch. Technological and techno-functional method, which has been shown as efficient in revealing the homogeneity and variability of lithic industries from a techno-cognitive perspective (Inizan et al., 1995; Boëda, 2001, 2013; Li, 2011; Li et al., 2009b, 2011b; Li and Bodin, 2013; Bodin, 2011, among many others), has not been applied to Chinese materials in a systematic way, but has considerable potential in future studies of the Chinese Paleolithic. To date, few regions have been intensively researched apart from Zhoukoudian, the Nihewan and Bose basins and the Three Gorges region, which makes it difficult to investigate large-scale lithic variability. Fortunately, in the past few years numerous stone artifacts and fossils attributed to the Pleistocene have been found in the Hanshui River Valley, and these provide sufficient materials for exploring the intra and inter-regional homogeneity and variability of lithic industries. This paper reviews the Paleolithic sites in the Hanshui River Valley and studies several lithic assemblages by applying a lithic technological and techno-functional methodology.

2. History of discovery of and research into Paleolithic remains in the Hanshui River Valley

From the 1950s–1980s, many human and other mammalian fossils and stone artifacts were discovered in caves and open-air sites, including Meipu Longgu Cave (Li, 1980; Wu and Dong, 1980), Xinghuashan (Qiu et al., 1982), Bailong Cave (Li, 1980), Xiaokongshan lower and upper caves (Xu, 1980; Zhang, 1982; Wang et al., 1988), Zhangnao Cave (Huang et al., 1987), the Liangshan Longgangsi site (Yan, 1980; Yan and Wei, 1983; Huang and Qi, 1987; Tang et al., 1987) and Xuetangliangzi, a.k.a. the *Yunxian Man* site (Li and Etler, 1992; Yan, 1993; Chen et al., 1997; Li et al., 1998; Li and Feng, 2001). In the 1990s and due to the construction of the South-North Water Diversion Project of the Chinese government, more than 100 Paleolithic sites were discovered on Terraces 2 and 3 of the Hanshui River and its branch the Danjiang River (Li, 1998; Li et al., 2009a, 2011a). From 2006, most of these Paleolithic sites were excavated and yielded a wealth of archaeological remains, mainly stone artifacts from unambiguous stratigraphic contexts. These sites include Shuangshu (Li et al., 2007), Jiantanping (Hou and Li, 2007), Pengjiahe (Pei et al., 2008a), Dudian (He, 2009), Beitaishanmiao (Zhou et al., 2009), Longkou (Wang, 2011), Huangjiawan (Fang et al., 2011), Boshan (Song, 2011), Waibiangou and Datubaozi (Li et al., 2011a), Liuwan (Feng et al., 2012), Beitaishanmiao-2 (Fang et al., 2012), Songwan (Niu et al., 2012a), Baidutan (Niu et al., 2012b), Houfang (Li and Sun, 2013), Guochachang-II (Li et al., 2013), Dishuiyan (Liu and Feng, 2014), Yuzui-2 (Chen et al., 2014b), Shuiniuwa (Chen et al., 2014a), Hongshikan-I (Li et al., 2014a, 2014b) (Fig. 1). In the upper reaches of the Danjiang River, regional surveys were also conducted from the 1990s and more than ten localities contained about 900 stone artifacts on Terraces 2 and 3 (Wang and Hu, 2000; Pei and Song, 2006). At the same time, the local museum of Shiyan City made some surveys to find Paleolithic localities (Li et al., 1987; Li, 1991; Zhu, 2005, 2007; Wu et al., 2008b). From 2000, an important breakthrough was made in research of the *Yunxian Man* site through the collaboration of Chinese and French researchers, who undertook multi-disciplinary analyses with new techniques in archaeology, paleoanthropology, sedimentology, micro-morphology, geochemistry, and palynology (De Lumley and Li, 2008). Overall, about 130 Paleolithic sites that often contain large lithic assemblages and are sometimes associated with hominid remains and other fossils have been discovered in the Hanshui River valley, making it one of the most intensively investigated areas of Paleolithic sites in China and East Asia.

3. Geographical and geological background

The Hanshui River, 1577 km in length and the largest tributary of the Yangtze, takes its source at Zhongshan, Ningqiang County, in the southeast of Shaanxi Province, which is situated between the Qinling Mountains and Micangshan Mountain. It flows through the center of China from northwest to southeast, with a drainage area of 159,000 km^2, covering mainly the provinces of Shaanxi, Henan, and Hubei and joining the Yangtze at Wuhan (Han, 2003). Located in central China and characterized by a humid subtropical monsoonal environment, the Hanshui River valley represents an important transitional zone between north and south China (Fig. 1). It is composed of deposits belonging to different periods, among which the most extensive are Paleozoic metamorphic series, followed by Neogene red clay and Quaternary sediments (Shen, 1956). The river itself was mainly formed at the end of the Neogene. In the Quaternary, fluvial erosion and intermittent tectonic movements associated with the uplift of the Qinghai-Tibetan Plateau formed four terraces from bottom to top in the upper reaches of the river: the modern flood plain less than 10 m above the river bed; an alluvial terrace at 10–15 m; a red clay terrace at 30–40 m; and a compound terrace at 70–80 m (Shen, 1956). The majority of Paleolithic sites were discovered in the upper reaches of the Hanshui River and Danjiangkou Reservoir Region, in deposits of Terraces 2–4 of the Hanshui and its branch the Danjiang River. Although the height of terraces varies in different parts of these valleys, the deposits of each terrace were mostly consistent and comparable, which helps determine the age of sediments yielding archaeological evidence.

4. Geochronology, taphonomy and sedimentology

Geochronology is a difficult issue for Paleolithic sites in the Hanshui River Valley. For cave sites and the *Yunxian Man* site, the

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