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## Case report

## Variations in the Upper Paleolithic adaptations of North China: A review of the evidence and implications for the onset of food production

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## ABSTRACT

The Upper Paleolithic (UP) of North China has the richest archaeological data and longest history of research in the Paleolithic archaeology of China, but there is a relative lack of systematic studies addressing human adaptations. This paper explores the spatial and temporal variability of human adaptations in terms of mobility, the key variable in the adaptive systems of hunter-gatherers. We find that before the UP, little adaptive differentiation is shown in the archaeological record of North China. The early Upper Paleolithic (EUP) is distinguished by four distinctive modes of mobility and subsistence organized roughly along lines of habitat variation. These modes persisted in the Late Upper Paleolithic (LUP), underlying the widespread prevalence of microblade technology throughout North China. This pattern significantly influenced adaptive changes during the transition from the terminal Pleistocene to early Holocene. Earliest food production emerged in hilly flank habitats where EUP mobility decreased quickly and social organization was more complex. This retrospective view of UP adaptations highlights the important role that prior conditions played at the evolutionary crossroads of prehistoric North China.

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## 1. Introduction

The Upper Paleolithic (UP) was a watershed in human evolution, a time when genetically modern humans colonized all continents except the Antarctic and adapted to diverse habitats from plateaus to coasts. At the same time, the UP also foreshadows the end of the era of foraging-dominated lifeways, and the cultural trajectory of the Holocene was certainly influenced by the prior state of UP cultural processes. The expansion of archaeological research in North China in recent decades, including new chronological sequences, paleo-environmental data, and especially lithic artifacts and modes of their analysis, offers a new opportunity to examine the Upper Paleolithic in fresh perspective.

Research design and results for Upper Paleolithic in China have been influenced by contingencies of discovery as well as changing research objectives that have influenced the state of our knowledge today. For many years, UP studies in North China were dominated by a paradigm of lithic techno-typology that was used to reconstruct a cultural-historical framework at a regional scale (Qiu et al., 2013). More recently, studies have begun to pay attention to topics such as “behavioral modernity” (Gao et al., 2010; Gao, 2014; Li et al., 2014; Norton and Jin, 2009) and cultural exchanges between the west and the east sides of Eurasian continent (Hou, 2005; Huang et al., 2009). The theme of adaptation has

been only marginally addressed in several studies (e.g., Gao and Pei, 2006; Madsen et al., 2007), thus not much is known about adaptive strategies and tactics of UP foragers of North China. In addition to constraints imposed by paradigms, our knowledge is also limited by variable preservation and the conditions of the archaeological record. The social turmoil of the past century in China has also profoundly influenced the quality of fieldwork, methods used, and ability to report and publish archaeological research. Consequently, it is largely impractical to make detailed quantitative comparisons of individual artifact assemblages. Yet it is still within our power to provide a large-scale, holistic view of available materials for the benefit of researchers interested in this archaeological record, and attempt to frame research questions regarding its significance. In this review, we will discuss the current state of our knowledge about the UP in North China, including a summary of major UP archaeological discoveries and materials. We will also briefly examine the prior evidence from the pre-Upper Paleolithic and emerging information about the Early Upper Paleolithic. This information will be synthesized to identify patterning indicative of adaptive changes of the UP to evaluate the major, yet variable, adaptive transformations that announce the onset of Early Holocene food production.

## 2. Upper Paleolithic foraging: an adaptive perspective

Adaptation for modern humans involves problem-solving using physical and cultural strategies. The mechanism of culture, an

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extrasomatic means of adaptation (Binford, 1962), has predominated since the late Pleistocene. Human cultures are characterized by time-transgressive accumulation and inter-generational transmission (Tomasello, 1999), thus human adaptation is the outcome of past processes that condition a repertoire of alternative responses, and the ways that repertoire is deployed to meet emerging challenges. For our topic, we need to consider both aspects: the long-term process in human adaptation that forms the backdrop of conditions for events we wish to study, and dynamic problem-solving tactics that are used to meet present challenges. The former involves cultural sequences derived from the archaeological record of past human adaptation. The latter is related to hunter-gatherer ethnographies, which provide crucial reference information for hypothesis creation.

With the exception of foraging societies adjacent to exceptionally resource-rich environments (for example the densely populated and sedentized foraging cultures of the Pacific Northwest Coast in North America), hunter-gatherers like those of Pleistocene North China faced with changing ratios of consumers to resources (from increasing local population densities, climate or environmental change, and so forth), can offset resource stress with adaptive strategies like increasing mobility, broadening diet spectrum, storage, exchange, sharing, and intensifying key resources (e.g., Bettinger, 1991; Kelly, 1995; Binford, 2001). Among these strategies, mobility plays a critical role. Mobility offers not only the resources needed for food and technology, but is also critical to vital information about local conditions generally (e.g., climate, environment, potential mates, allies, trading relationships, etc. [Binford, 1983; Yu, 2015]). As hunter-gatherer mobility is diminished, so is the feasibility of making a living exclusively from wild resources. The significance of mobile foraging to hunter-gatherers is analogous to food production among traditional farmers and market economy to modern societies: it is a key causal variable that influences settlement patterns, social organization, and even ideology. Further, mobility can be assessed using archaeological indicators (e.g., lithic materials and site structure and distribution), as compared to paleo-demographics or even climate change.

Of the materials that are used to study UP adaptations, human remains are no doubt the most direct in that they can reveal diet, health condition, strength, life expectancy and other proxies that are relevant to human adaptation. However, human remains from this period are still very rare, especially in North China. Sometimes other biological materials such as faunal and floral remains can reflect ecological conditions and food sources. Nevertheless, these species must be firmly associated with human activities, which is rare at the archaeological sites of North China. For example, 77 faunal species found in the Gulongshan site were all attributed to human hunting, although only several somewhat ambiguous stone tools have been uncovered (Zhou et al., 1990). It is likely that humans were only one of several formational agents for these large deposits of animal bones.

Fortunately, there is a large body of lithic material accessible to Paleolithic archaeologists, not only durable but highly variable. These lithics preserve different orders of temporality in their acquisition, manufacture and discard (Gamble, 1999: 125). They are not only typological, but simultaneously conceptual, technical and economic (Perlès, 1992: 224). Experts on lithic analysis have developed conceptual frameworks (e.g., Bleed, 1987; Hayden et al., 1996) and many exemplary studies on large-scale phenomena like global microlithization (Elston and Kuhn, 2002). These works help to incorporate lithic technologies with mobility. In addition, organic residues on stone tools may also provide extra information about the resources which these tools were used to process. Related work has begun with UP materials from North China (Guan et al., 2012). Sometimes lithic materials are found in situ with other artifacts such as organic tools, ornaments, and hearths. These objects constitute spatial patterns in site organization, which may indicate the organization of mobility. Binford's (1980) model for foragers versus collectors presents a useful framework for explaining the spatial patterns of North China's UP materials, and more significantly, could partly

explain post-Pleistocene adaptive frameworks along a continuum of persistence of hunting and gathering to the initiation of food production.

Using an evolutionary perspective, Clark (1969) devised a rough five-mode summarization of lithic technologies over the world. Shea's (2013) updated lithic categories presents a new nine-mode scheme, more logically rigorous albeit at the expense of simplicity and the evolutionary perspective. He notes that the appearance of a new technology does not necessarily replace the prior one, but rather may add more technological resiliency in solving problems. With these considerations in mind, we will see a prominent feature in the evolution of lithic technology: that is, the growing prevalence of UP blade and microblade technologies (in the paper it means pressure-flaked microblade) trends toward increased portability and maintainability of stone tools. Composite tools with stone insets are evidently useful in increasing mobility of foragers (Goebel, 2002). Global microlithization in the later Paleolithic could also represent this trend (Elston and Kuhn, 2002). Interestingly, lithic technologies of the Neolithic period are precisely reversed from UP lithics, in that durability of tools in sedentary situations becomes more important than portability. This was coincident with the transition from hunting-gathering to food production, to be discussed in detail later in this paper.

To date, certain patterns in UP adaptations are commonly held among archaeologists although they also acknowledge wide variations in different regions. One noteworthy consensus is the emphasis on big-game (e.g., herbivore) hunting. In an evolutionary sense, this represents a long-term tendency toward energy maximizing; that is, obtaining as much energy as possible in the shortest time duration through use of technology and other means. Big-game hunting not only brings large packages of highly ranked foods, but also can help able individuals acquire mates or prestige through the mechanism of costly signalling (Grimstead, 2010). The ability to hunt large-bodied game through the use of sophisticated technology and logistically organized groups is more relevant to fully modern humans (Binford, 1988). Globally, this behavior appears to ebb and flow in the UP; the archaeological record of Italy, for instance, suggests that human hunters intensified hunting returns by preying on slow growing animals (e.g., turtle) and agile small animals (e.g., hare), probably as a density-dependent response of intensification (Stiner et al., 1999, 2000). With the wide-spread extinctions of big game species at the end of the Pleistocene, human hunters had to change their food preferences, with attendant changes in the hunting toolkit.

In sum, we assert that lithic variability is closely related to mobility of human foragers. Both the weight and functional effectiveness of stone tools are variables that cannot be overlooked in the process of mobile foraging, which in turn influences lithic form and function. Lithics therefore can reflect adaptive characteristics, and help to identify patterning indicative of adaptive change. By examining lithics, site organization, and faunal remains at a regional scale as in North China, we can explore the UP adaptations of hunter-gatherers from a mobility perspective.

### 3. Setting the stage: adaptations before the UP

#### 3.1. An ambiguous Middle Paleolithic

As a foundation to North China's UP adaptations we first address the basic characteristics of their antecedents — although these can be hard to pin down due to uncertain dates and geological contexts. The validity of the 'Middle Paleolithic' in North China has been repeatedly questioned (Gao, 1999; Gao and Norton, 2002; Norton et al., 2009), with increasing justification, in our view. One example of this ambiguity is the Middle Paleolithic site of Xujiayao (Jia et al., 1979), whose distinctive lithic assemblage includes thumbnail-shaped scrapers, end scrapers, notched scrapers, proto-prismatic cores, and a large number of spheroids. The Xujiayao toolkit may also include antler tools, as cut

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