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A chain of tools: An experimental study on picks of the Qinling region

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ABSTRACT

Picks are a common lithic tool in the Qinling region, where an Acheulean-like industrial complex dominated during the early Paleolithic. They are assumed to be manufactured by the technology of direct percussion flaking. This experimental study indicates that the trihedral points of picks cannot be produced by this technology, but are produced by throwing. The benefit of using the method is not only to obtain trihedral blanks, but also includes producing blanks of other tools such as cleavers, handaxes, knives, and choppers. These products are different components of a whole chaine d'operatoire for stone tool production. Participation in the experiment by both males and females suggests that the latter can also use the method of throwing to produce all these blanks, although there are some differences in the mass of cobble used and throwing power. As females are able to produce heavy tools like picks, there is no reason to assume that heavy tools were made only by males, in particular, for the purpose of sexual symbols.

1. Introduction

Picks are a common type of stone tool in China before the Upper Paleolithic, and an important element of the Chinese Acheulean lithic complex (Wang, 2007; Kuman et al., 2014). They are also widely found in southern China from the early Paleolithic to the Neolithic. Current lithic research has not paid any particular attention to this tool, especially on the way it was made. It is generally assumed that picks were made from cobbles by direct percussion flaking, but this supposition is not fully supported by experimental evidence. It is also assumed that picks are an independent tool type, but we do not know if pick manufacturing correlates with the production of other tool types, or why they can coexist in the same lithic complex. This research used lithic experiments to explore the manufacturing technology of picks, in particular, the trihedral pick, as well as the influence of this technology on other coexistent tool types. It also attempts to consider the influence of sexual differences on the process of production.

2. Experimental archaeology

Experimental methods are particularly applicable for studying lithic technology, not only because the same raw materials can be used, but also because past and modern humans share a common body structure and the same physical constraints, especially after the appearance of *Homo erectus*. Although there may exist some differences between ancient and modern humans in muscular power, technique and cognition, similar variations also exist in modern humans. Difficulties in lithic technology among modern people would also most likely have been experienced by our ancient ancestors. The principle of uniformitarianism is reasonable at the level of lithic technology, so that experimental methods can provide a fundamental way of understanding manufacture technologies of stone tools from all periods.

Lithic experiments have been used since the early 19th century, peaked in 1970s (Johnson, 1978), and are still common. They were widely applied, from the reconstruction of flaking technology (e.g., Crabtree, 1972) to analysis of use wear (Semenov 1964; Odell, 1975; Keeley, 1980). The major problem in what archaeologists can learn about past human behavior by using this method is the degree of regional variability in cultural history and ecological conditions. A feasible strategy is to answer questions by lithic experiments that should be directed by archaeological patterning (Amick et al., 1989). If further correlated with regional cultural histories and cultural–ecological relationships, lithic experiments can play a greater role in answering particular questions of a region or cultural stage (Chen et al., 2013, 2014b).

Johnson (1978) has reviewed the history of lithic experiments over the past hundred years, and was perplexed by the extent to which later researchers rarely noticed the work of their predecessors. She attributed this to the temporal gaps between

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researchers and experimenters. The real reason is probably that the study of lithic experiments requires the participation of researchers. If researchers were only the observers, it would be difficult for them to really understand variations resulting from subtle changes during the experimental process. The personal experience with tool manufacture is always more informative.

3. Definition and variability of picks

It is not easy to define the term "pick", although it is not difficult to find that its definition overlaps with the handaxe (Debénath and Dibble, 1994). For Bordes (1961:69), picks typically, "are very elongated bifaces, with a thick section that is more or less quadrangular, or sometimes triangular." Handaxes are also technically bifaces. Tavoso (1978:28) defines picks as unifaces with a trihedral point, of which the triangular section is obtained by the flaking of an angular pebble (or flake) from two faces. Some handaxes have sharp points from both retouched faces, so they are called a "pick-like handaxe" (Debénath and Dibble, 1994). In Chinese Paleolithic archaeology, stone tools similar to picks in form were given different names including trihedral points (e.g., Dingcun, see Wang, 2014), pointed choppers, large points, and *Zhuo Jue Qi* (digging tools, see Huang and Qi, 1987). Nowadays, the term "pick" has been accepted by most archaeologists as a type of stone tool different from handaxes, choppers, and cleavers, all of which are components of the Acheulean Industrial Complex, sometimes also called LCT (large cutting tools) artifacts.

The discovery of picks in China suggests that this tool is distributed very widely. In addition to the Qinling region (Wang, 2007; Chen et al., 2013), they are also frequently found in Hunan (Yuan, 2013) and Guangxi (Xie et al., 2003; Zhang et al., 2010) provinces. In recent years, they have also been found in Guangdong, where picks are characterized as having bulky forms and unifacial retouch. Discoveries of picks are reported in other provinces such as Anhui (Fang 2004), Zhejiang (Xu, 2009), Fujian (Lin et al., 2006; Fang et al., 2013), and Jiangxi (Li and Xu, 1991), but the numbers are small. All the above-mentioned data come from southern China, but the distribution of this tool is not limited to there. In the north, the Dingcun group of sites in Shanxi province has typical trihedral points (Wang, 2014) (one of which is now a part of the logo on the cover of *Acta Anthropologica*), but these should be called picks. Recently, picks are claimed from Northeast China. The neighboring Korean Peninsula also contains picks, handaxes and other Acheulean-like tools (Lee and Woo, 2013). In terms of temporal span, the Acheulean industry of Africa extends from 1.76 Ma (Kuman and Clarke, 2000) to 0.3–0.25 Ma (Clark, 2001). The earliest picks of China can be traced to the "large point" found in the Lantian area (Dai, 1966) and Xihoudu (Jia and Wang, 1978), still controversial. If true, they may be synchronous with the earliest Acheulean. The latest picks can be seen in the Upper Paleolithic of Hunan, for instance, at the Tiaotougang site (Yuan, 2013), and even in some Neolithic sites of Guangxi (personal communication, Guangmao Xie). However, in the Qinling region, the Acheulean-like lithic industry was replaced by a flake-dominated technology in the Upper Paleolithic.

The Qinling region encompasses the zones surrounding the Qinling Mountains, including the upper Han River valley in the south and the Luo River in the north (Fig. 1). The most systematic report about picks in the Qinling region comes from the Luonan Basin, Shaanxi, where picks have been found at all excavations and surveys of open-air sites (Wang, 2007). In contrast, no picks have been found at the Longyadong cave site although it was thoroughly excavated, and tens of thousands of lithic artifacts were recovered (Wang, 2008). The picks of the Luonan Basin are of two basic types: the common and the trihedral pick. The former has an irregular section and a retouched point, while the latter has a trihedral point with or without any retouch. The raw materials used generally include quartzite, quartz sandstone, and fine sandstone.

Regarding the manufacturing of picks, it has been argued that common picks are made from the blanks of large flakes or flat cobbles (Wang, 2007). The retouched method is said to have the cutting edges bifacially retouched (Tavoso, 1978). As for trihedral points, the manufacturing technology is regarded as the same as for the common pick. According to the data from the Luonan Basin, the average thickness of common picks is 57.62 mm (N = 124), which is less than that of trihedral picks, 69.54 mm (N = 107) (Wang, 2007). This means that larger blanks had to be used in manufacturing trihedral picks, probably from large blocky chunks. Furthermore, our excavation in Yuzui site (Chen et al., 2014a), located to the south of the Qinling Mountains, discovered trihedral picks that are characterized by an unretouched point and a retouched adjacent edge (Fig. 2). Trihedral form comes from one fracture, rather than intentionally repeated retouches. However, in the region (Danjiangkou Reservoir Region), there is also a different scheme of classification of the types of picks (Kuman et al., 2014), which are divided into pick-like handaxe and unifacial cobble pick. Here, we emphasize the importance of technology in pick manufacture. The sturdy point of trihedral picks without any retouch comes from the blanks. The method of obtaining this form of blank is illustrated by lithic experiments.

4. Experimental studies on picks

Stimulated by our observation on the trihedral picks, we began experimental studies. This is a repeatedly tentative process, in which it is impossible to start from controlled experiments, because our questions are also extracted from the process. This study includes four experiments, which are discussed below.

4.1. Experiment 1

This experiment was initiated from the Yuzui site. A band of cobbles was unearthed with scattered choppers and picks (Chen et al., 2014a). To understand the lithic technology used at the site, we used the cobbles found in the band to replicate choppers and picks. The experiment was successful in the replication of choppers (Chen and Chen, 2012), as these were easy to produce from flat and oval cobbles, either by percussion flaking or by block on block techniques. This shows that the chopper is a typically expedient tool. Unfortunately, the replication experiments on picks failed, no matter which method was used: we could not manufacture a trihedral point without any retouch, similar to the picks found at the Yuzui site.

Each pick has a cutting edge as well as a trihedral point (Fig. 2), and could therefore be used for cutting or chopping with the cutting edge, or for digging with the point. Picks are smaller and lighter than the choppers found at the site. Retouch does not touch the trihedral point on which there is no scar, but occurs on other parts of picks without damaging the tip. Picks are thus a type of tool resulting from intentional design and careful modification, in contrast with choppers, which are highly expedient.

4.2. Experiment 2

This experiment was carried out in the summer of 2014 on the floodplain of the Luo River near Longyadong cave site, where there are numerous cobbles of all sizes. We used two methods to produce picks. One was direct percussion. The raw materials were flat oval cobbles, ~20 cm long, 15 cm wide and 7 cm thick. The hammers used were an average of 800 g. The choice of size and form