The development of Upper Palaeolithic China: new results from the Shuidonggou site

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The Shuidonggou site cluster in northern China contains 12 different early prehistoric sequences with great potential to cast light on the transition to Upper Palaeolithic behaviour in East Asia. Here researchers present the latest results from Locality 2, reporting seven occupation levels with hearths, animal bone and diverse industries. Although previously compared with European Upper Palaeolithic sequences, the new work proposes a different trajectory of development. Distinctive macroblade technology arrived in the area, possibly from Mongolia or Siberia, about 41 000–34 000 years ago. This industry subsequently disappeared, to be replaced by flake technologies.

Keywords: China, Shuidonggou Locality 2, lithic technology, Oxygen Isotope Stage 3

Introduction

The replacement of archaic populations by anatomically modern humans, and the process of the Middle–Upper Palaeolithic transition in Eurasia during Oxygen Isotope Stage 3 (OIS 3) are heavily debated in the scientific community (e.g. Mellars 1990; Bar-Yosef & Pilbeam

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2000; Mellars *et al.* 2007). Much discussion focuses on the age of blade technology, which is considered by many as a marker of modern humans, and its diffusion across Eurasia.

Shuidonggou Locality 1, located in northern China, has yielded what has been described as an initial Upper Palaeolithic assemblage with large blades produced by Levallois-like technology (Brantingham 1999; Brantingham *et al.* 2001). This site occupies a unique position in early prehistoric China (e.g. Jia *et al.* 1964; Zhang 1990, 1999a; Li 1993; Lin 1996; Gao *et al.* 2002, 2004) and historically has been aligned with the Eurasian Palaeolithic (Boule *et al.* 1928; Bordes 1968; Brantingham 1999; Brantingham *et al.* 2001). Given that there are few other well-studied, securely dated assemblages in China that resemble the early Eurasian Upper Palaeolithic (Lin 1996; Gao 1999), Shuidonggou plays an essential role in discussions of the diffusion of blade technology and even population migration across Eurasia from west to east.

The phase of research at Shuidonggou that began in 2003 focuses on the dating, depositional context, lithic industries, and behaviour patterns of several localities in the Shuidonggou Basin. Shuidonggou Locality 2, the subject of this paper, is significant for its unusually long sequence of seven distinct, well-stratified Palaeolithic layers and an abundance of archaeological material. The results from the investigation provide a new perspective on the origins and age of macroblade industries in the region.

The site

The Shuidonggou Basin is located in northern China, 18km east of the Yellow River on the margins of the Ordos Desert (Figure 1). It lies in an arid to semi-arid transition zone which is strongly seasonal and has a continental climate, dominated by the winter monsoon. The site cluster at Shuidonggou was first located and investigated by Émile Licent and Pierre Teilhard de Chardin in 1923 (Licent & Teilhard de Chardin 1925). Teilhard de Chardin initially noted five distinct localities in the Shuidonggou Basin. In the course of subsequent studies, another seven Palaeolithic localities have been identified (Zhang 1999b; Gao *et al.* 2004, 2009; Liu *et al.* 2008).

The Palaeolithic deposits in this area cover a time span of roughly 41–10 ka cal BP (Table 1). Several technological complexes have been identified, marked by the presence of large blade technology, simple core-flake technology and microblade technology. More specifically, Localities 1 and 9 and the earliest layers at Locality 2 yield assemblages with large blade production incorporating aspects of Levallois technology, for which Shuidonggou is best known. Most of the layers at Localities 2, 7 and 8 contain assemblages with simple core-flake technology. Evidence of microblade technology was discovered at Locality 12 (Liu *et al.* 2008; Gao *et al.* 2009), where it is dated to 11 ka by optically stimulated luminescence (OSL) dating (Liu *et al.* 2008). Microblades and cores were also found at the surface of Locality 6 (Zhang 1999b). To date, the assemblages from other localities are either small or difficult to classify.

Shuidonggou Locality 2 was one of the five localities originally identified in 1923 by Licent and Teilhard de Chardin (1925). Madsen *et al.* (2001) and Gao *et al.* (2002) conducted some radiocarbon (AMS ^{14}C) dating work in 1999 and 2000 based on samples from around hearths exposed in the natural profile (Madsen *et al.* 2001; Gao *et al.* 2002). They placed

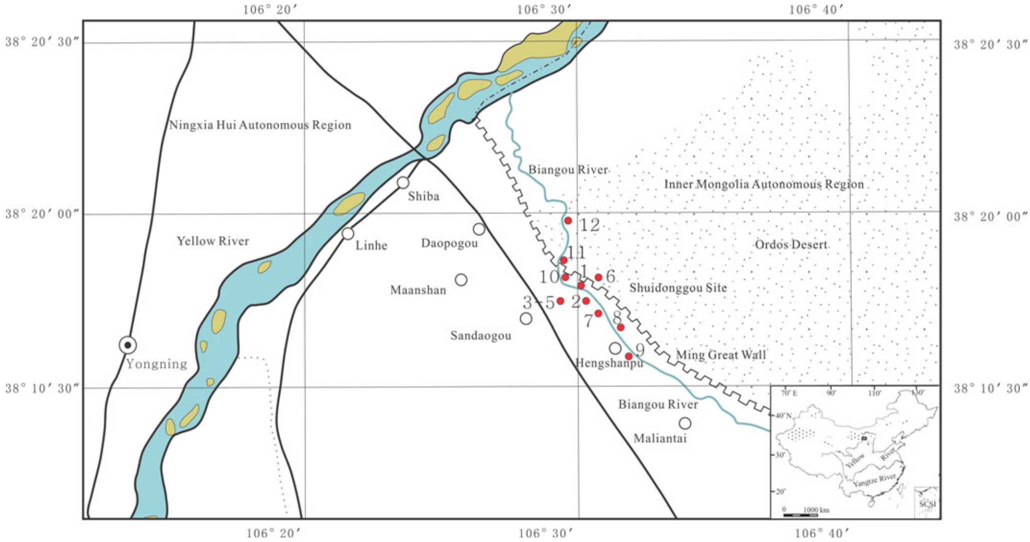

Figure 1. Map of northern China showing the location of the Shuidonggou site cluster (modified after Liu et al. *2009), numbers 1–12 represent Shuidonggou Locality 1 to Locality 12.*

the occurrence of blade technology in this area at an age of between 29 ka and 24 ka (^{14}C BP) based on the dates from Locality 2, and suggested that large blade technology spread from north to south during the Upper Palaeolithic. From 2003 to 2007 Gao *et al.* excavated several localities (Gao *et al.* 2006, 2008a; Pei *et al.* 2012), Locality 2 being one of the most intensively studied sites.

Stratigraphy and chronology at Locality 2

Locality 2 has been excavated over an area of almost 100m^2 (Figures 2 and 3), revealing seven cultural layers (CL) containing several hearths, thousands of stone artefacts, bone fragments and some ostrich eggshell beads. Eleven hearths or depositional features related to hearths were identified: two of them in CL1, seven in CL2, one in CL3 and one in CL4. All are flat to slightly basin-shaped unprepared hearths ranging in diameter from 0.2–1m and in depth from 40–100mm. The hearths are surrounded by charcoal fragments, stone artefacts and bones (Figure 3). Fire-cracked pebbles were found in or immediately adjacent to most of the hearths. Most of the bone fragments were discovered in hearths and close to them suggesting that meat preparation and consumption was concentrated around the fireplaces (Guan *et al.* 2011).

The exposed strata reached a total thickness of 12.5m (Figure 4). The sedimentary sequence from unit two, the more complete of the two trenches, is described and interpreted as mainly lacustrine deposits by Liu *et al.* (2009). The sediments at the base are fine sand and gravel; these give way successively to a greyish-black peat deposit (CL7), then light greyish-green silt, and finally light greyish-yellow silt (see Liu *et al.* 2009 for complete and detailed descriptions of stratigraphy). A total of 18 substrata are described (Figure 4), seven

Table 1. Dating results from Shuidonggou Locality 2.

Cultural layer	Original unit	Context	Material	Dating method	Lab #	Age (BP)	Cal (BP)* (95.4%)	Reference
SDG2-CL1	Strata 4	Profile	Sediment	OSL	IEE1880	20 300±1000		Liu *et al*. 2009
SDG2-CL2	Hearth 1	Profile	Charcoal	AMS ^{14}C	Bata-132982	26 350±190	30 984±152	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 2	Profile	Charcoal	AMS ^{14}C	Bata-132983	25 670±140	30 519±175	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 2	Profile	Ostrich eggshell	AMS ^{14}C	Bata-132984	26 930±120	31 273±88	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 3	Profile	Charcoal	AMS ^{14}C	Bata-134824	26 830±200	31 239±111	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 4	Profile	Charcoal	AMS ^{14}C	Bata-134825	25 650±160	30 503±197	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 5	Profile	Charcoal	AMS ^{14}C	Bata-146355	26 310±170	30 966±147	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 7	Profile	Charcoal	AMS ^{14}C	Bata-146357	29 520±230	34 149±342	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Hearth 10A	Profile	Charcoal	AMS ^{14}C	Bata-146358	23 790±180	28 607±290	Madsen *et al*. 2001; Gao *et al*. 2002
SDG2-CL2	Strata 6	Profile	Ostrich eggshell	AMS ^{14}C	Bata-207935	28 420±160	32 734±330	Gao *et al*. 2008b
SDG2-CL2	Strata 6	Profile	Charcoal	AMS ^{14}C	Bata-207936	28 330±170	32 605±344	Gao *et al*. 2008b
SDG2-CL2	Strata 6-2L3	*In situ*	Charcoal	AMS ^{14}C	BA110217	26 450±120	31 071±92	
SDG2-CL2	Strata 6-L18	*In situ*	Charcoal	AMS ^{14}C	BA110218	30 360±120	34 881±124	
SDG2-CL2	Strata 6-L20-H6	*In situ*	Charcoal	AMS ^{14}C	BA110219	25 090±90	29 933±199	
SDG2-CL2	Strata 6-2L4	*In situ*	Charcoal	AMS ^{14}C	BA110220	26 040±90	30 802±142	

Table 1. Continued.

Cultural layer	Original unit	Context	Material	Dating method	Lab #	Age (BP)	Cal (BP)* (95.4%)	Reference
SDG2-CL2	Strata 6-L20-H7	*In situ*	Charcoal	AMS ^{14}C	BA110221	2 520±30	2 606±77	
SDG2-CL2	Strata 6-L21-H7	*In situ*	Charcoal	AMS ^{14}C	BA110226	895±30	824±53	
SDG2-CL3	Strata 8-L27	*In situ*	Bone	AMS^{14}C	BA110223	28 290±110	32 561±300	
SDG2-CL3	Strata 8-L28	*In situ*	Bone	AMS ^{14}C	BA110222	27 190±100	31 385±94	
SDG2-CL3	Strata 8	Profile	Sediment	OSL	IEE1881	27 800±1400		Liu *et al*. 2009
SDG2-CL4	Strata 10	Profile	Sediment	OSL	IEE1882	20 500±1100		Liu *et al*. 2009
SDG2-CL4	Strata 10-L30	*In situ*	Charcoal	AMS ^{14}C	BA110224	985±30	883±48	
SDG2-CL5b	Strata 13	Profile	Sediment	OSL	IEE1883	29 200±2100		Liu *et al*. 2009
SDG2-CL5b	Strata 13	In situ	Bone	AMS ^{14}C	BA110227	20 280±70	24 191±151	
SDG2-CL6	Upper part of Strata 15	Profile	Sediment	OSL	IEE1884	23 600±2400		Liu *et al*. 2009
SDG2-CL6	Lower part of Strata 15	Profile	Sediment	OSL	IEE1885	38 300±3500		Liu *et al*. 2009
SDG2-CL7	Upper part of Strata 16	Profile	Sediment	AMS ^{14}C	BA07940	29 759±245	34 395±328	Liu *et al*. 2009
SDG2-CL7	Lower part of Strata 16	Profile	Wood	AMS ^{14}C	BA07943	36 329±215	41 445±213	Liu *et al*. 2009
SDG2-CL7	Strata 16	*In situ*	Wood	AMS ^{14}C	BA110228	980±30	877±47	

*^{14}C dates were calibrated using Oxcal 4.1 online software (IntCal 09 curve).

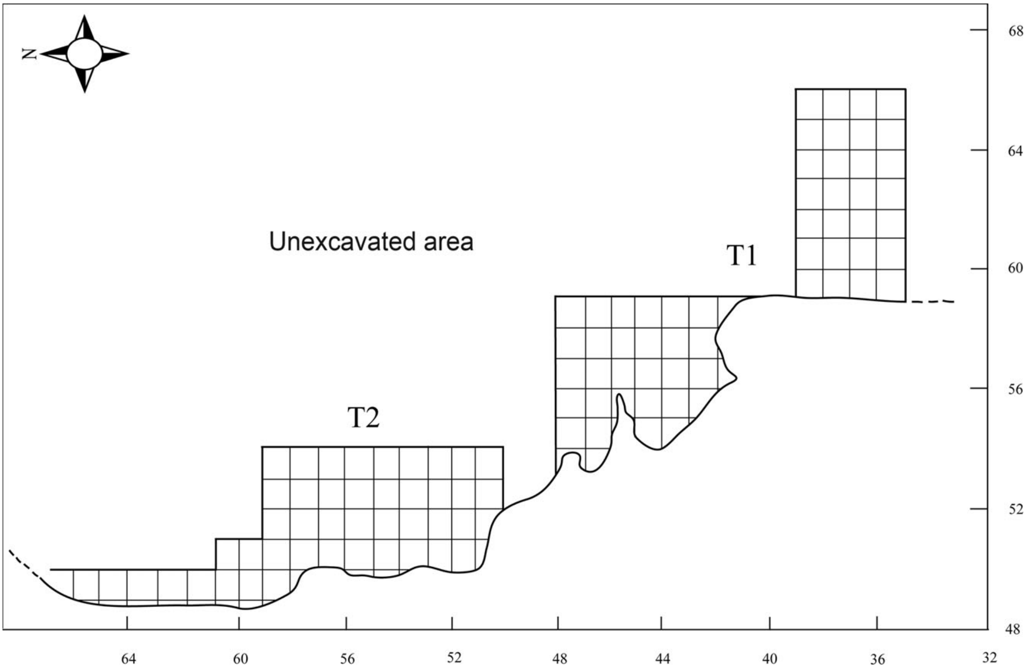

Figure 2. Diagrammatic plan of excavated trenches and metre-squares at Shuidonggou Locality 2.

of which contain relatively concentrated debris from Palaeolithic occupations. A few stone artefacts were also collected from other substrata.

The combined radiocarbon dates (Table 1) show that the first cultural layer (CL7) falls within the period from 41.5–34.4 ka cal BP; the second and third (CL6 and 5) are expected to date from 34.4–32.6 ka cal BP (based on ages of strata above and below); the fourth and fifth (CL4 and 3) 32.6–31.4 ka cal BP; the sixth (CL2), 31.3–29.9 ka cal BP; the seventh (CL1) 20.3 ka (OSL BP) (Li *et al.* 2013).

Technological and typological features of the assemblages

The range of materials collected from Locality 2 during the recent excavation includes lithic artefacts, animal fossils and ostrich eggshell beads. The three-dimensional coordinates of specimens discovered *in situ* were recorded with a Total Station. All sediments from 20–50mm artificial levels were dry-sieved through fine mesh (*c.* 2mm.). The sample from Locality 2 is thus relatively complete, and is also large enough for our analysis (>15 000 stone artefacts).

Table 2 summarises some of the basic technological characteristics of the lithic assemblages from different cultural layers from Locality 2. Most of the artefacts are manufactured from quartz sandstone, low-quality chert and silicified dolomite obtained as well-rounded pebbles from nearby river banks. Based on the size of the artefacts, the pebbles selected appear mostly to have ranged from 30–150mm in diameter. A small proportion of artefacts produced from black and grey high-quality chert in the assemblage from CL2 preserve white, chalky cortex,

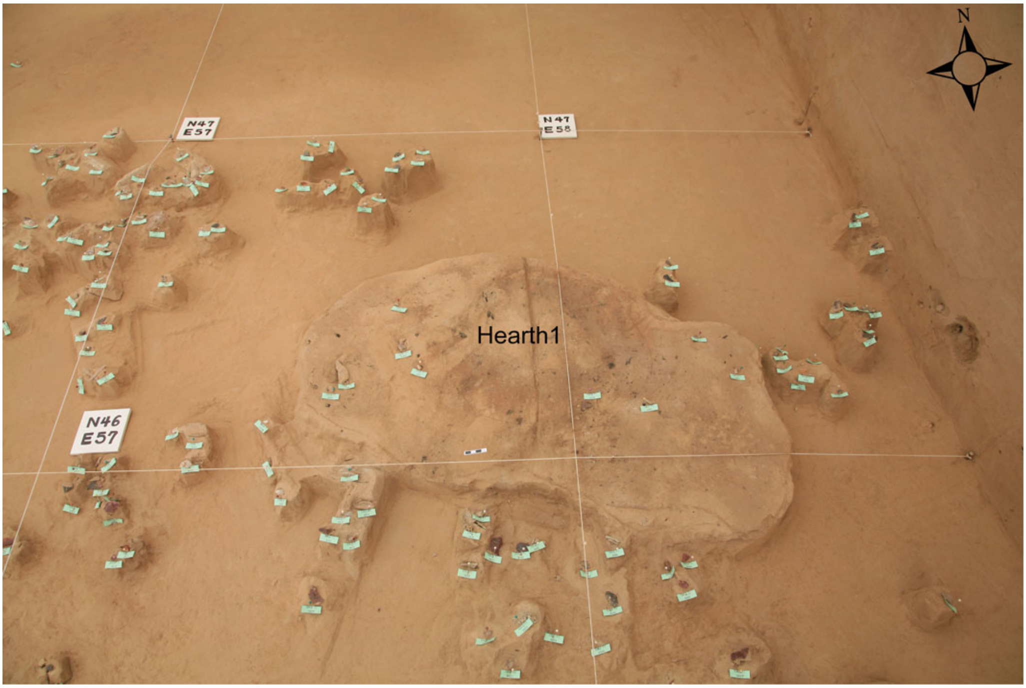

Figure 3. Plan view of hearth 1 and associated artefacts in cultural layer 1 at Shuidonggou Locality 2 (each square represents 1m^2).

showing that they were obtained directly from a source of chert nodules, rather than from secondary alluvial deposits. Unfortunately, this primary source has not yet been identified.

In terms of the retouched tool inventory, all assemblages from Locality 2 are clearly flake-based, although there is some variation among the various layers. Blade and blade-like flakes as blanks for tools are extremely rare, but CL7 and CL5a yielded two large blade cores (Figure 5), the only ones from the entire sequence. Overall, the majority of stone tools from CL6, CL5b and CL4–CL1 exhibit clear features of the small flake tool tradition of northern China (Zhang 1990, 1997, 2002).

The proportion of cores is quite small in every cultural layer. According to the morphological and technological traits, all cores from CL6 to CL1 except for CL5a exhibit features of simple flake manufacture with free-hand percussion (Figure 6); the two cores from CL7 and CL5a that were clearly used for systematic blade production are obvious exceptions (Figure 5). The core from CL5a is a Levallois-like flat-faced bidirectional core with two faceted platforms, and the other, from CL7, is an edge-faceted blade core with platforms on two opposite ends. These two cores are regionally distinctive but exhibit obvious similarities to cores from the larger assemblage at Shuidonggou Locality 1, which has been described as an initial Upper Palaeolithic industry (Brantingham 1999; Brantingham *et al.* 2001). Cores from CL6, CL5b and CL4–CL1 were all exploited to produce simple flakes and show no preparation of the platforms and working surfaces. Bipolar cores and flakes were found in CL5 to CL1 (Figure 6), but their number and proportion both increase dramatically in the most recent assemblage (CL1a). In most cases, hard hammer percussion seems to have

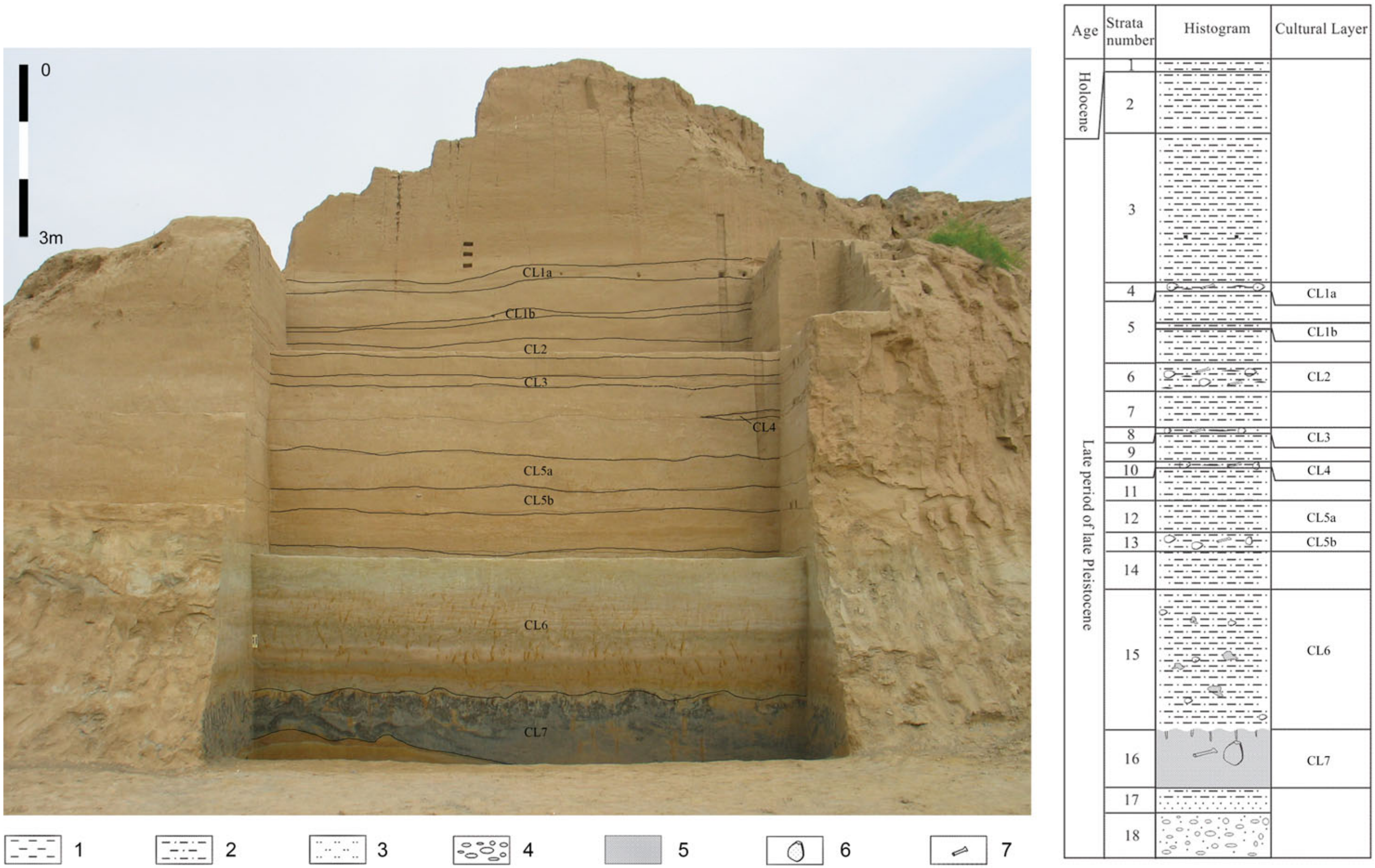

Figure 4. The profile at Shuidonggou Locality 2, with cultural layers indicated, in excavation unit 2 (table is modified from Liu et al. *2009). 1, clay-rich silt; 2, silt; 3, fine sand; 4, gravel; 5, peat; 6, stone artefact; 7, animal fossil.*

Table 2. Technological features of assemblages from different cultural layers at Shuidonggou Locality 2.

Cultural layer	Blade core	Simple flake core	Bipolar core	Flake	Flake fragment	Bipolar flake	Chunk	Manuport	Fire-cracked pebble	Hammers/ Anvil	Retouched tool	Grinding tool	Total
CL1a	–	50	109	575	378	831	6078	84	1	10	76	1	8193
	–	0.61%	1.33%	7.02%	4.61%	10.14%	74.19%	1.03%	0.01%	0.12%	0.93%	0.01%	
CL1b	–	4	4	8	6	5	77	20	–	1	2	–	127
	–	3.15%	3.15%	6.30%	4.69%	3.94%	60.63%	15.75%	–	0.79%	1.58%	–	
CL2	–	17	13	780	312	68	858	11	7	–	48	–	2114
	–	0.80%	0.61%	36.90%	14.76%	3.22%	40.59%	0.52%	0.31%	–	2.27%	–	
CL3	–	21	4	140	60	41	578	23	–	–	6	–	873
	–	2.41%	0.46%	16.04%	6.87%	4.70%	66.21%	2.63%	–	–	0.69%	–	
CL4	–	2	2	25	14	5	31	2	–	–	1	–	82
	–	2.44%	2.44%	30.49%	17.07%	6.10%	37.80%	2.44%	–	–	1.22%	–	
CL5a	1	–	–	–	–	–	1	8	–	–	–	–	10
	10.00%	–	–	–	–	–	10.00%	80.00%	–	–	–	–	
CL5b	–	10	2	14	3	3	150	68	–	3	8	–	261
	–	3.83%	0.77%	5.36%	1.15%	1.15%	57.47%	26.05%	–	1.15%	3.07%	–	
CL6	–	2	–	1	–	–	11	–	–	–	1	–	15
	–	13.33%	–	6.67%	–	–	73.33%	–	–	–	6.67%	–	
CL7	1	1	–	2	–	–	3	8	–	–	–	–	15
	6.67%	6.67%	–	13.33%	–	–	20%	53.33%	–	–	–	–	

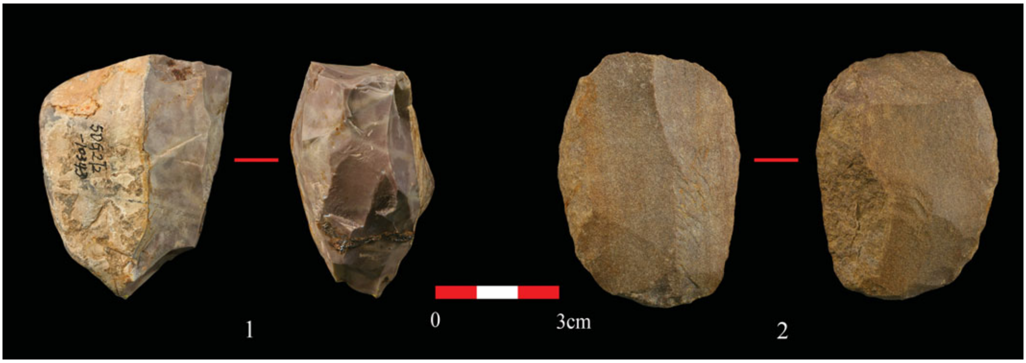

Figure 5. Macroblade cores from CL7 and CL5a at the Shuidonggou Locality 2. 1: edge-faceted core (CL7); 2: flat-faced, Levallois-like core (CL5a).

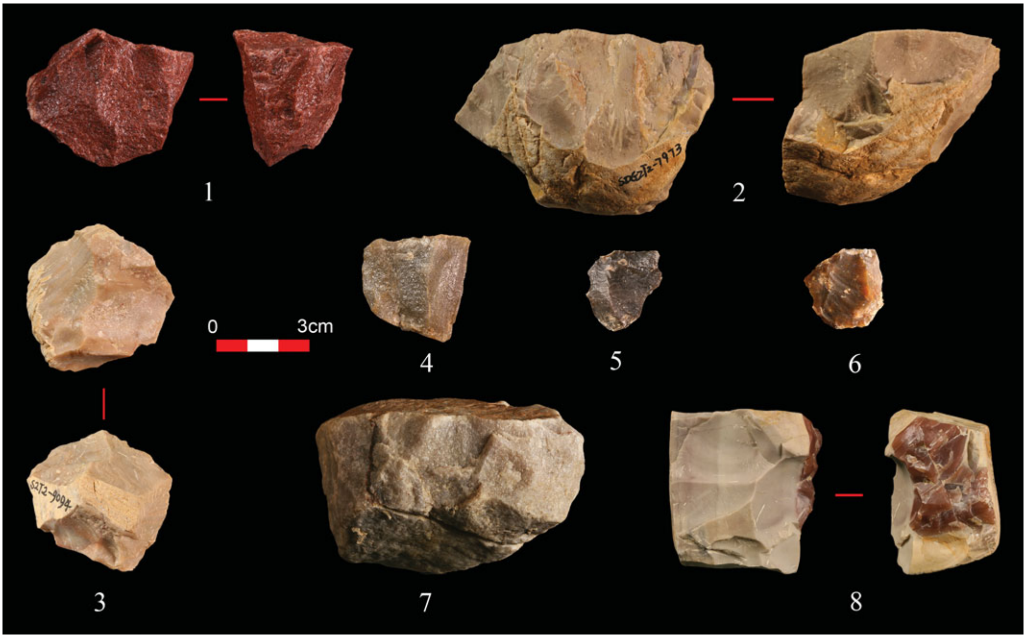

Figure 6. Free-hand hard-hammer percussion and bipolar cores from CL1–4 and CL5b at the Shuidonggou Locality 2. 1, 3 and 8: multiple-platform cores; 2 and 7: single platform cores; 4–6: bipolar cores. 1 and 4 are from CL1; 2, 5 and 6 are from CL2; 3 is from CL3; 7 is from CL4; 8 is from CL5b.

been the dominant technique for detaching flakes. However, several flat blanks from CL2 flaked on black chert from the primary (non-local) source exhibit traces of soft-hammer percussion, including small or invisible platforms, a distinct lip on the ventral edge of the platform, and evidence of preparation by grinding at the exterior of the platform (e.g. Kuhn 2004). There are no counterpart cores showing evidence of soft-hammer percussion from this layer, although we might not expect to find them if the raw material source were far away.

Table 3. Counts and frequencies of retouched tools from different cultural layers at Shuidonggou Locality 2.

Cultural layer	Side-scraper	End scraper	Point	Drill	Burin	Notch	Chopper/ chopping tool	Other
CL1a	43 56.58%	12 15.79%	3 3.95%	2 2.63%	1 1.32%	3 3.95%	2 2.63%	10 13.26%
CL1b	2 100%	–	–	–	–	–	–	–
CL2	28 58.33%	8 16.67%	–	3 6.25%	–	2 4.17%	1 2.08%	6 12.50%
CL3	5 83.33%	1 16.67%	–	–	–	–	–	–
CL4	1 100%	–	–	–	–	–	–	–
CL5a	–	–	–	–	–	–	–	–
CL5b	6 75.00%	2 25.00%	–	–	–	–	–	–
CL6	1 100%	–	–	–	–	–	–	–
CL7	–	–	–	–	–	–	–	–

Overall, the assemblages from Locality 2 reveal two broadly different core reduction technologies. Cores from CL7 and CL5a demonstrate clear features of large blade technology which connects these layers with Locality 1. The dates from CL7 (41–34ka cal BP) and CL5a (>32.6 ka cal BP) are also in reasonably good agreement with dates from the layers (34 ka and 38 ka, U-Th BP) containing products of a similar core reduction sequence at Locality 1 (Li *et al.* 2013). Cores from other main cultural layers (CL6, CL5b and CL4–CL1) at Locality 2 show the simple free-hand core reduction and bipolar reduction which are very common at contemporary late Pleistocene Palaeolithic sites in northern China (e.g. Zhang 1990, 1997, 2002).

No retouched tools were recovered from the layers associated with large blade cores at Locality 2. The retouched tools from CL6, CL5b and CL4–CL1 are typologically and technologically characteristic of the northern Chinese Late Pleistocene Palaeolithic (Table 3). The frequency of retouched tools is very low, as is the intensity of modification on each specimen. The most abundant retouched tools from CL6, CL5b and CL4–CL1 are side-scrapers (Figure 7), most of which are manufactured on relatively flat flakes. Endscrapers manufactured mainly on flakes are the second most common artefact class in CL2 and CL1a, while endscrapers are nearly absent from earlier layers. Other tool forms, including points, notches, burins, drills and choppers occur in small numbers in the assemblages from every cultural layer at Locality 2.

For a variety of reasons related to both conditions of preservation and human activities, a small sample of faunal remains was retained from the 2003–2007 excavation, but unfortunately most of the fauna elements are small bone fragments for which it is difficult to make taxonomic determinations. Based on tooth counts the mammal component of the fauna from CL2, the largest faunal assemblage, is dominated by *Equus hemionus*

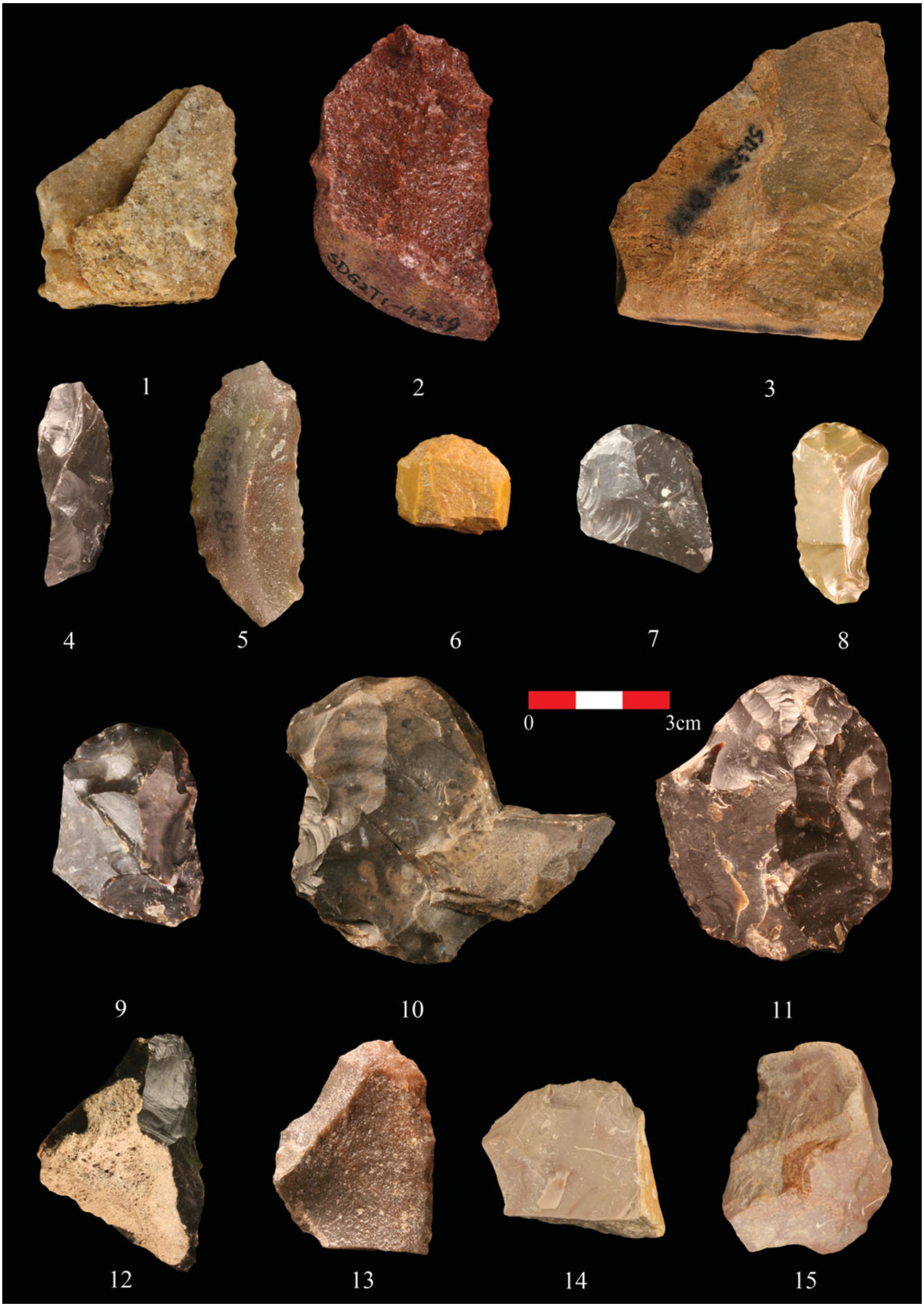

Figure 7. Stone tools from Shuidonggou Locality 2. 1–4: single side-scrapers; 5, 12, 13 and 15: double side-scrapers; 6–11 and 14: endscrapers. 1, 2 and 6 are from CL1; 3–5 and 7–13 are from CL2; 14 is from CL3; 15 is from CL5b.

and *Antelopina*. While the use of ostrich (*Struthio* sp.) for food is unclear, a handful of ostrich eggshell beads (*Struthio andersoni,* from analysis on the collections from the surface) (Wang *et al*. 2009) were recovered. All beads come from CL2, as does one bone needle fragment.

Discussion

The reduction sequences indicated by cores from CL7 and CL5a at Shuidonggou Locality 2 fit well with the general characteristics of initial Upper Palaeolithic technology from Locality 1. The manufacture of blades by hard-hammer percussion from prepared cores seems to be an especially good indicator of this phase. Not surprisingly, distinctive 'index fossils' of other initial Upper Palaeolithic or 'transitional' assemblages from the Near East—*chanfreins*, Emireh and Uum et Tlel points (Kuhn *et al.* 1999)—are not found in the Shuidonggou Upper Palaeolithic layers. However, the Shuidonggou materials are similar to the earliest Upper Palaeolithic assemblages from south Siberia, such as Kara Bom, and from Mongolia, such as Chikhen Agui (Brantingham *et al.* 2001), suggesting the existence of a regional initial Upper Palaeolithic in central Asia, south Siberia, Mongolia and north-west China.

Re-examination of the dates of initial Upper Palaeolithic layers at Shuidonggou Localities 1 and 2 places this stage within a rough time span of 38–34 ka (Li *et al.* 2013). Taking account of these dates for Levallois-like blade technology in northern China, the hypothesis that the technology spread from north to south and that "Shuidonggou is the latest initial Upper Palaeolithic assemblage yet known in all of Eurasia" proposed by Madsen *et al.* (2001: 715) should be re-evaluated. The radiocarbon ages cited by Madsen *et al.* (2001) were derived from samples from hearths located higher in the sequence, probably CL2; no such fireplaces were identified below CL4. The estimate of 41–34 ka for CL7 and the age determination of >32.6 ka (CL3) for CL5a place them within the same time range as the Mongolian sites with macroblade technology. Although dates for the Siberian assemblages with initial Upper Palaeolithic blade technology are considerably older (e.g. Derevianko 2011), the temporal gap between Shuidonggou and the Siberian sites is shorter than previously estimated, suggesting a more rapid spread of techniques or populations from the north and west. Unfortunately, for the time being at least, the absence of well-dated sites in adjacent parts of north-west China, such as Xinjiang Province and Inner Mongolia, make it impossible to chart the introduction and spread of blade technology into north-west China in greater detail.

It is also clear that the late Pleistocene sequence from Shuidonggou is more diverse than previously characterised. Assemblages from CL6 to CL1 (except for CL5a) at Locality 2 are similar if not identical to many late Palaeolithic assemblages in northern China predating the emergence of microblade technology, and fit technologically and typologically within the so-called flake-tool cultural tradition (Zhang 1990, 1997, 2002). These assemblages share a number of general features including local raw material exploitation, free-hand percussion, amorphous or variable cores, irregular flakes, high proportions of chunks and debris, and informal tools with little retouch, sometimes combined with bipolar products. Some behavioural changes are also observed among different layers at Locality 2, including variable intensity of occupations (based on densities of finds), different patterns of raw material procurement in CL2 and an increase in bipolar reduction products in CL1a. Assemblages from main cultural layers (CL6, CL5b and CL4–CL1) share little with the initial Upper Palaeolithic and appear to have their roots in the Late Pleistocene Palaeolithic industries of northern China. The existence of such different technological systems in successive layers runs counter to the common impression of Shuidonggou as a site containing only Levallois-like blade technology. Levallois-like blade technology was practiced in this area for one or more relatively brief periods during the Upper Palaeolithic, after which more typical small flake-tool technologies were produced for almost 14 000 years. Moreover, the early blade technology had no obvious impact on the practices of subsequent occupants according to the archaeological materials, probably indicating that two different populations, representing different cultural traditions, occupied the Shuidonggou area successively during OIS 3.

Madsen *et al.* (2001) proposed a hypothesis based on the findings at Shuidonggou Locality 2 that microblade technology originated from a combination of blade technology and bipolar technology. Examination of the bipolar products at Locality 2, especially the cores, cannot tell us about the details of that evolutionary process. Even though the detached products are similar in dimension, bipolar technology involved very distinct flaking procedures from microblade technology, which requires a systematic preparation of the platform and working surface and usually employs a pressure flaking technique (Kuzmin *et al.* 2007). Moreover, cultural layers at Locality 2 which yielded artefacts made by bipolar technology yielded no blade products, implying that blade technology did not influence bipolar technology at all. The abundance of bipolar products in CL1a is not a precursor to the development of microblades, but instead represents a response to some functional and economic requirement for very small flakes, the nature of which is currently unknown.

Conclusion

The varied lithic technology from Locality 2, combined with Shuidonggou's geographic position between arid and semi-arid areas, should lead to a better understanding of the western and eastern Eurasian Upper Palaeolithic sequences, and the possible interactions between these two areas. The Upper Palaeolithic in northern China/East Asia is regionally very distinct from the blade-dominated Upper Palaeolithic of Western Europe, and Western Europe should not be seen as typical of the processes that occurred in East Asia. As Shuidonggou Locality 2 demonstrates, a distinctive form of macroblade technology was introduced into northern China, probably from Mongolia or Siberia, as early as 40 ka, but subsequently disappeared, to be replaced by local flake-based production systems. The scale of variation among these areas should stimulate scholars who are interested in the Palaeolithic in East Asia to propose a unique Palaeolithic system for East Asia, not only in terms of stages of the Palaeolithic (Gao 1999; see also Gao & Norton 2002), but also the behavioural patterns and adaptive strategies in East Asia.

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