

# Late Paleolithic site at Locality S9 of Shizitan Complex in Jixian County, Shanxi

**Shizitan Archaeological Team, Shanxi Provincial Institute of Archaeology**

## Abstract

Locality S9 within the Shizitan site complex in Jixian County, Shanxi Province is one of the late Paleolithic sites at Shizitan. This locality yielded rich cultural remains. Chipped stone technology, similar to that common in North China, is represented by small sized flake stone tools including scrapers, points and choppers, which was produced by hard-hammer percussion, followed by pressure flaking technique for micro-blade production. Stone querns, stone grinding rollers, pigment pieces and pigment pulverizing tools, and ornaments made of clam shells and ostrich eggshells are also unearthed. Shizitan Locality S9 cultural remains provided abundant information for researches on the transition from late Paleolithic to early Neolithic periods in the region as well as on origins of agriculture in North China in general.

**Keywords:** Microblade; Paleolithic Age; Shizitan Site (Jixian County, Shanxi)

## General introduction

Shizitan site complex, first identified in 1980, is situated on the bank of Qingshuihe River, a tribute to Yellow River, which is 2km to the west of the site. The site is about 30km southwest of Jixian County seat in Shanxi Province. In 2000 through 2010, a collaborative investigation team consisting of archaeologists from Shanxi Provincial Institute of Archaeology, Shanxi University and the Commission for Preservation of Ancient Monuments of Jixian County undertook systemic surveys and excavations in the region. The survey revealed that Paleolithic localities were densely distributed within a 15km stretch of Qingshuihe

River valley from Datianwo Village to Xicun Village. The results suggest that Shizitan is the so far known the largest and richest Late Paleolithic site complex being excavated in the country. Locality S9 falls into one that is placed in the latest phase of the complex chronologically.

S9 site was identified in 2000, and excavated over the three sessions in 2001, 2002 and 2005. The excavated depth through the deposit is about 455cm, exposing areas of 25sq m (expanded from original 13sq m). A total of artifacts recovered counts to 2359 pieces; additional 5000 pieces were recovered through screening and sieving.

## The stratigraphy

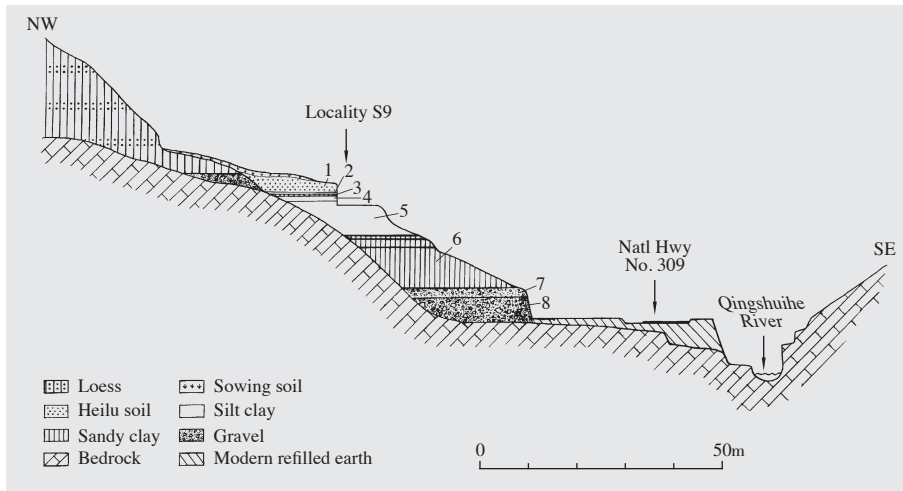
S9 site is located on the second terrace of the west bank of Qingshuihe River, at an altitude about 688m above the sea level. It is on the rear portion of the terrace, 38m above the Qingshuihe River bed, and 150m north from the center of Gaolouhe Village that is under administration of Boshansi Township in Jixian Country (Figure 1).

The deposit in stratigraphy illustrates deep in north and shallow in south portion at the site, while balancing across east and west. The excavation profile displays 8 stratigraphic layers (Figure 2).

Layer 1: Dark-brownish grey Heilu soil, 170cm in thickness; hard sediment with well-developed vertical joints containing light yellowish calcareous concretions



**Figure 1** The landscape of Locality S9 (S-N) of Shizitan Site.



**Figure 2** Stratigraphic profile at S9.

1 and 3. Greyish brown Heilu sediment layers; 2, 4 and 5. yellowish brown sandy silt layers; 6. loess sandstone layer; 7. gravel layers; 8. riverbed gravel layer



**Figure 3** Hearth (S-N).

and various-sized sandstone gravels.

Layer 2: Yellowish dark-brown silt clay, 30-36cm in thickness; hard and condensed sediment containing few light yellowish calcareous concretions. No cultural remains were recovered.

Layer 3: Dark-brownish grey Heilu soil, 26-36cm in thickness; similar to Layer 1.

Layer 4: Yellowish dark-brown silt clay, 120cm in thickness; hard and condensed sediment containing irregularly-distributed calcareous concretions and coarse rocks, as well as occasional charcoals.

Layer 5: Yellowish dark-brown silt clay, 800cm in thickness; excavated depth is about 200-230cm; the sediment similar to Layer 4, containing circular silt chunk in irregularly-distribution but less charcoals.

Layer 6: Loose sandy clay, 100cm in thickness; there are three strips of sediments, 3-5cm each in brownish red color at upper part of the layer.

Layer 7: gravel layer about 80cm in thickness; cobble are moderated weathered, consisting of grayish yellow sandstone, grayish green sandstone, and mudstone.

Layer 8: riverbed gravel, average 400cm in thickness; cobble stones are as large as 170cm in diameter, poorly weathering-rounded, consisting of sandstone and mudstone in various color such as brownish-red, grayish yellow, grey, grayish black, and yellowish green, all probably derived from bedrocks.

Underneath Layer 8 is the bedrock layer, formed in Permian and Triassic periods.

### The features

During 2001 excavation session, an ash pit, in 10-20cm diameter, was identified beneath Layer 3 (Figure 3). It was speculated as the remain of temporary hearth-use activities. Charcoals in the center of the pit were hardened into chunks, surrounded with scattered small charcoals at the same level. Most of animal bones including rodent's skull, limbs and teeth, display burnt features. Associated lithic artifacts include choppers, scrapers, micro-cores, blade and micro-blade, etc. Under the level of hearth, there are also scattered charcoals found.

### The cultural remains

There are a total of 2359 artifacts recovered from S9 Layers 1, 3, 4, and 5. The assemblage includes 1652 lithic artifact, 695 faunal remains, and 12 shell artifacts (Figures 4 and 5).

#### 1. Lithic Artifacts

The cultural remains are mainly represented by lithic artifacts, accounting for 70% of the total number recovered. Raw materials of lithic artifacts are primarily of cherts in various colors (N=1168), followed by quartzite (N=372), agate (N=20), and vein quartz (N=25). In addition, there are also a few lithic artifact made on sandstone, mudstone, and flakes. Types of lithic assemblage vary including cores, flakes, micro-core, micro-blade, chunks, fragments, chips, tools, utilized flakes, and stone blocks, all together 1646 in number. In additional, there are two querns, two grinding rollers, one pigment fragment, and one pulverizing stone.

Core (N=24): cores are comprised of 1.5% of total lithic artifacts, all unearthed from Layer 4. Cores at the site are of hard-hammer percussions, dividing into three sub-categories: single platform cores, opposed platform cores, and multi-platform cores. Raw materials of cores

are mainly of quartzite and chert, most of which retain cortex. Most natural surface of the pebble nodule served as striking platform.

**Flake (N=718):** flakes are comprised of 43.5% of total lithic artifacts. Except three bipolar flakes, all flakes were produced by hard-hammer percussion and pressure flaking techniques.

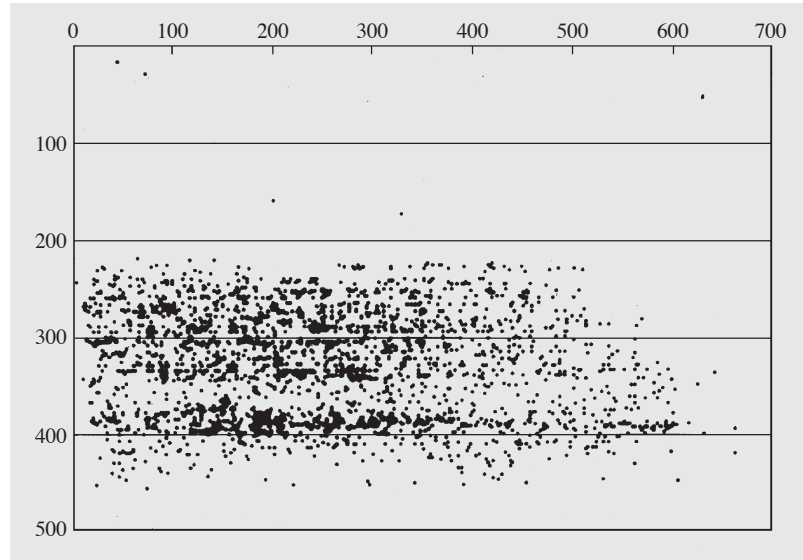
Three bipolar flakes were made of chert, displaying clearly opposed striking points, radiation waving and fractures (Figure 6:7, 7:32 and 7:35). Their sizes are small, about 2-3cm in length. According to the characteristics of striking platform, this study classifies the rest of flakes into two categories: cortex platform and facet platform. Thus, there are 128 flakes having cortex platform accounting for 17.8% of total flakes. The rest of flake assemblages are ones with facet platform (Figures 7:12, 7:16 and 7:28). Furthermore, 194 flakes retain original cortex component either on platforms or on dorsal surfaces, accounting for 27% of the total lithic artifacts.

**Micro-cores (N=8):** micro-cores comprised of 0.5% of total lithic artifacts, made of chert of various color. They are further classified into four sub-categories: columned cores (Figures 6:16 and 7:7), conformed cores (Figures 7:9 and 7:20), wedged cores (Figures 6:14, 7:2 and 7:25), and cores made on fractured flakes (Figure 7:22). All cores were products of manufacturing process, showing at least three core facet scars on each core.

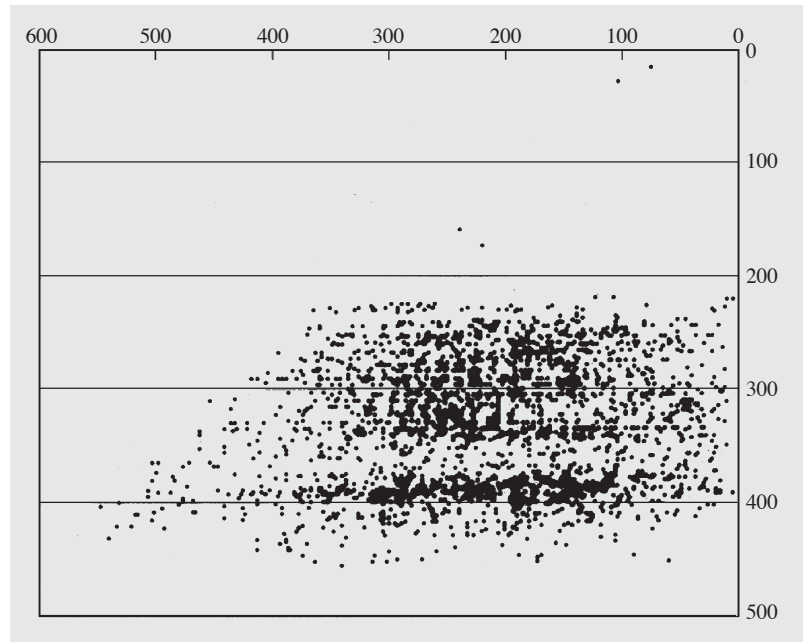
**Micro-blade (N=144):** micro-blade is comprised of 8.7%. 44 complete micro-blades have average 1.5cm in length (Figure 7:26), with a few being 2.5cm. Fragments include 63 proximal-end sectioned, 26 middle sectioned, and 11 distal-end sectioned micro-blades. Micro-blades are made on raw materials of chert in different color. S9:405 is the only piece made on grayish quartzite, displaying at least four negative scars of micro-blade being previously detached (Figure 7:6).

The appearances of micro-blades were similar in frequencies from different layers. Due to low numbers of micro-cores as well as different raw materials between micro-cores and micro-blades, thus refitting analysis is not possible. According to observation of raw materials, 144 micro-blades are probably detached from at least 35 cores of different raw materials.

**Chunks and fragmentary flakes (N=267).** They are comprised of 16.2%, among which there are 133 chunks and 134 fragmentary flakes.



**Figure 4** Artifact distribution shown on north wall profile at S9.

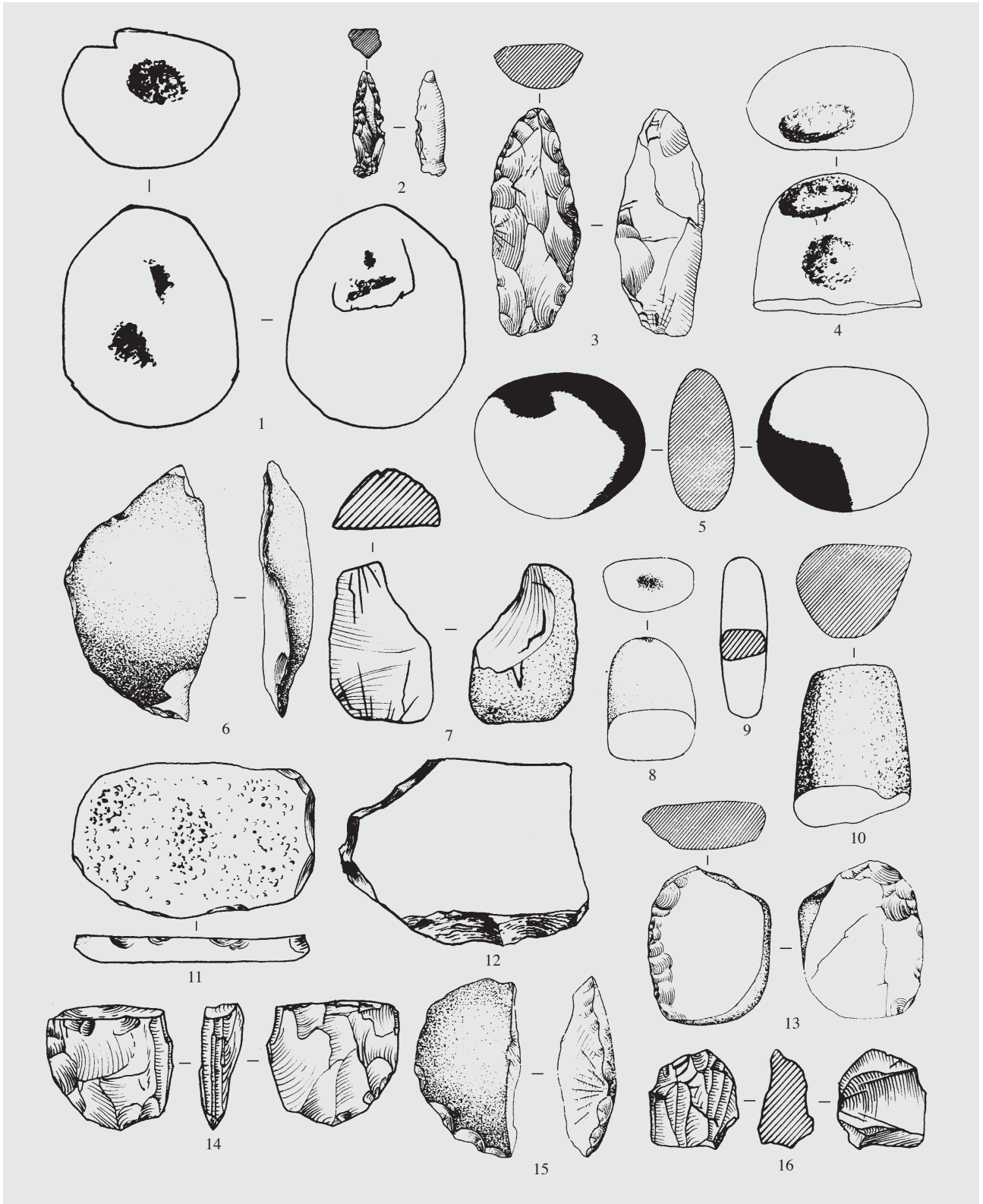


**Figure 5** Artifact distribution shown on West Wall profile at S9.

**Chips (N=346):** it is comprised of 20.9% of total lithic artifacts. Chips are those blow-offs during the percussion and retouch process, displaying no striking platform, bulb percussion and percussion point. Usually they are less than 1cm in length.

**Tools (N=54):** Tool is comprised of 3.3% of total lithic artifacts. The first category of tools are hammerstones (N=3), and the second category of tools are flake tools (N=51) including scrapers, end scrapers, points, and small choppers.

**Hammerstone (N=3):** One direct-freehand percussion hammerstone (S9:1071) is made on quartzite, but incomplete. The remaining part displays wear of chopping



**Figure 6** Unearthed artifacts.

1. Hammerstone (S9:361); 2. point (S9:2314); 3. point (S9:2309); 4. hammerstone (S9:1638); 5. pigment pulverizing stone (S9:534); 6. lunate scrapers (S9:1424); 7. flake (S9:126); 8. hammerstone (S9:1071); 9. grinding roller (S9:923); 10. grinding roller (S9:426); 11. quern (S9:448); 12. quern (S9:1084); 13. chopper (S9:108); 14. micro-core (S9:1333); 15. lunate scrapers (S9:1472); 16. micro-core (S9:940)

and chiseling (Figure 6:8). Two hammerstones combine direct-freehand percussion and bipolar percussion, in the shape of oval made of pebbles. The hammerstone S9:361 displays wear of chopping and chiseling along edges of the long axis; wear of such is also concentrated on one end of the tools about 3 x 3.5sq cm (Figure 6:1). The other S9:1638 display the wear on one end of the tool, while there are pitting areas on surfaces resulted from bipolar percussion (Figure 6:4).

Scrapers (N=24). Seven scrapers were made on quartzite, and the rest were made on cherts of various color. 17 scrapers were made on blanks of percussion flake, one of fractured flakes, and the remaining six scrapers were made on fragmentary flakes or chunks. Most of scrapers were manufactured through dorsal retouching, but others also were produced through ventral retouch and alternated retouch. Pressure detachments were applied during secondary modification, resulting scarring in scaled and paralleled pattern. Working edges have different patterns in straight, rounded, convex, and concave shapes.

Two scrapers are special in typology, named by some scholars as “lunate scraper”, which is relatively large in size. During the production, flakes with original cortex surface were flaked off into lunate shape blanks, the edges of which were retouched alternately (Figures 6:6, 6:15 and 8).

Five scrapers have a similar form as a result of manufacturing process. They were made on thin flake of chert. Edges were modified through dorsal retouch. While proximal ends were modified into notches, distal ends were retouched into point tip or rounded-point tip. They must have been used as hafted tools (Figures 7:5, 7:8, 7:13, 7:21 and 7:23).

24 end-scrapers were made primarily on chert (N=21), followed by quartzite (N=3). Blanks for end-scrapers were percussion flakes, except two chunks. Modification on working-end was processed through dorsal retouch, except only one that was retouched through ventral retouch. Edge angles of working-end fall between 50° and 75°, with an average of 59.4°. The shapes of tools are consistent, showing triangle and trapezoid in cross-section. Half the working-edges are about rounded or round-pointed ends, and the other half shallowly rounded or close to plat. Only two have straight working-end. Retouch on the working-end is consistent, mostly in parallel or semi-parallel pattern (Figures 7:1 and 7:4). All above-mentioned scrapers and end-scrapers were recovered from Layers 3 through 5.

Points (N=2): only recovered from Layer 5, made on flakes. S9:2309 is a dual-tip point made on greenish grey quartzite and through dorsal retouch. Dorsal surface were covered entirely with flaking scars. The tool is illustrated in semi-circle in cross-section and paralleling edge in a plane view. It is 10.3cm in length, 3.9cm in width, and 2cm in thickness (Figures 6:3 and 9). S9:2314 is a single-tip pointed tool, made on yellowish brown chert and through dorsal retouch. Its dorsal surface retain partially

original cortex. Trapezoid in cross-section, this proximal end of the tool is rather robust and thick. It is 4.8cm in length, 1.5cm in width, and 1.5cm in thickness (Figures 6:2 and 10).

Small chopper (N=1): S9:108 is made on fractured flakes of black chert. It is 6.9cm in length, 5.5cm in width, and 2.1cm in thickness. Its working edge was manufactured through both dorsal and ventral retouch (Figures 6:13 and 11).

Querns (N=2): S9:448 is made on flat sandstone with flaked edges in oval shape. From a plane view, it is illustrated like horseshoe shape with the center is about 0.5cm lower than its margins. The surface remains regularly many pits in 0.5cm in diameter. It is 27.4cm in length, 18.3cm in width, and 3cm in average thickness (Figures 6:11 and 12). S9:1084 is in irregular shape but made in similar method as the above one. Its surface remains also small pits. It is 26.4cm in length, 18.5cm in width, and 5.7cm in maximum thickness (Figures 6:12 and 13).

Grinding rollers (N=2): recovered from the same layers, all made on sandstone. S9:923 is 20.6cm in length, and its maximum diameter is 6.1cm. Heavily rounded at both end, and its middle section is about triangular in shape of cross-section (Figures 6:9 and 14). S9:426 has a remaining length of 7.1cm, and displays nearly triangular form in cross-section (Figure 6:10).

Pigment pulverizing stone (N=1): of quartzite and in near plat spheroid shape. There are parallel striations alongside of the long axis. The pigment shows brownish red color. It is 7.6cm in major diameter, 6.5cm in minor diameter, and 2.9cm thickness (Figures 6:5 and 15).

Ocher pigment (N=1): S9:370 is adopted with raw material similar to Triassic rock nearby. It retains two surfaces with parallel striation. The maximum diameters is 1.6 cm (Figure 7:29).

## 2. Faunal remains

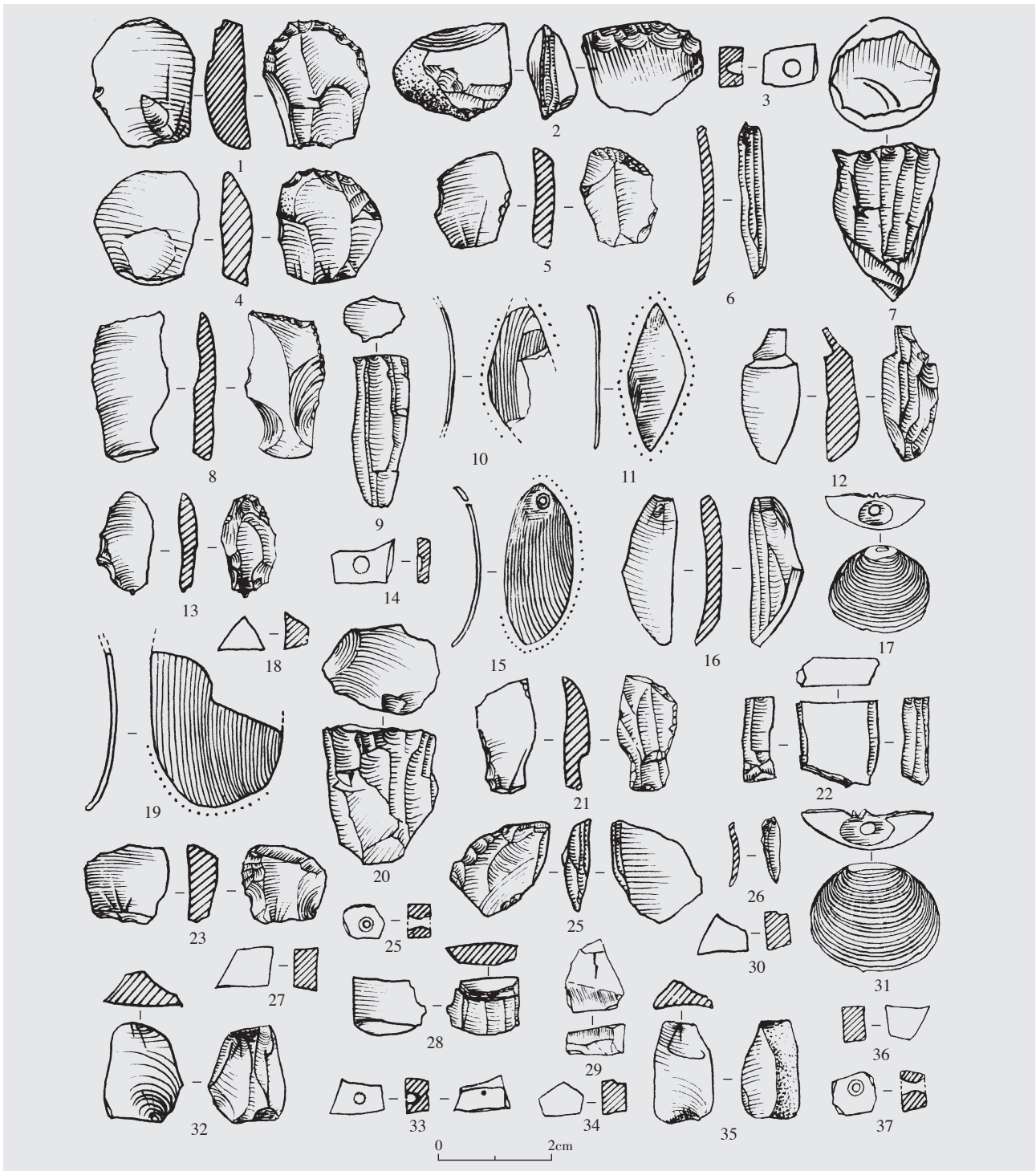
There are a total of 695 pieces, accounting for 29.5% of total cultural remains at the site. Most of the remains display burnt marks, and small in sizes (1-2cm in length). They are mostly in fragment and chunks. There are two categories of faunal remains that are identifiable to gene/species.

Mammal: Within Rodentia, there are skulls, vertebra, limb, pelvic, pubis, and phalanx bones belonging to *Myospalax fontanieri*. Within Lagomorpha, there are identified teeth and limb fragment. Within Carnivora, root of canine teeth, premolar teeth and limb bones are recovered. Within Artiodactyla, two horn cores belonging to gazelle in addition to limb and teeth are found.

Birds (Aves): Eggshells of ostrich (*Struthio. Sp.*) are found to be used as perforated ornaments. In addition, bones of unknown species are also identified. There is one bone bead with worn marks.

## 3. Shells

There are 12 shell artifacts both complete and incomplete. Among these, three shell ornaments are identified. S9:455 and S9:1066 are complete in half-fan



**Figure 7** Unearthed artifacts.

1. End scraper (S9:444); 2. micro-core (S9:1507); 3. ostrich eggshell; 4. end scraper (S9:1256); 5. scraper (S9:386); 6. micro-blade (S9:405); 7. micro-core (S9:264); 8. scraper (S9:1147); 9. micro-core (S9:394); 10. shell ornament (S9:1366); 11. shell ornament (uncompleted); 12. flake (S9:699); 13. scraper (S9:1815); 14. ostrich eggshell; 15. shell ornament (S9:1484); 16. flake (S9:1386); 17. shell ornament (S9:1066); 18. ostrich eggshell; 19. shell ornament (S9:888); 20. micro-core (S9:629); 21. scraper (S9:372); 22. micro-core (S9:1637); 23. scraper (S9:1386); 24. ostrich eggshell; 25. micro-core (S9:2177); 26. micro-blade (S9:980); 27. ostrich eggshell; 28. flake (S9:809); 29. brownish-red pigment (S9:370); 30. ostrich eggshell; 31. shell ornament (S9:455); 32. flake (S9:2121); 33. ostrich eggshell; 34. ostrich eggshell; 35. flake (S9:1526); 36. ostrich eggshell; 37. ostrich eggshell



**Figure 8** lunate scrapers.  
Left. S9:1424; right. S9:1472



**Figure 9** Point (S9:2309).



**Figure 10** Point (S9:2314).



**Figure 11** Small chopper (S9:108).



**Figure 12** Quern (S9:448).



**Figure 13** Quern (S9:1084).



**Figure 14** Grinding roller (S9:923).

shape. There is a perforation near the head part (Figures 7:31 and 7:17). S9:1484 is apparent of different species from the above two. Its edge was modified by chipping away the shell end. The oval shape shell ornament was perforated from inner side first, and then perforation was completed by drilling outside on the same spot. The perforation has a 1.2-1.3cm diameter (Figure 7:15). S9:888 and S9:1366 display edge modification but no perforation; both should be by-products (Figures 7:19 and 7:10).

### Artifacts from screening and sieving

A total of 4926 artifacts were recovered through screening sieving process during the excavations.

1. 394 lithic artifacts, accounting for 8% of total cultural remains from screening and sieving, and including 35 micro-blade made on cherts of various color. Most of these artifacts are small flakes and chipped as results of pressure flaking.

2. 4516 faunal remains, accounting for 91.7% of total cultural remains from screening and sieving, most are fragments. Except a few rodent's teeth and limb bones, most bones are unidentifiable.

3. Five shell artifacts, one of which was made on relatively plat shell, modified into a diamond shape, but no perforation (Figure 7:11).

4. 11 ostrich eggshells recovered from screening and sieving process, all from the upper part of Layer 4 (Figures 7:3, 7:14, 7:18, 7:24, 7:27, 7:30, 7:33, 7:34, 7:36 and 7:37). One was burnt causing its fragment, and the rest have a similar thickness 0.21cm and less than 0.6cm in width. They are flat and square or circle in form, being produced intentionally. Two of them were perforated bifacially, while an additional one was a mark of unsuccessful perforation attempts. Three were perforated from inner side only, leaving no trace outside of shell. The remaining five pieces were not modified. The diameter of perforations are about 0.12-0.13cm.



**Figure 15** Pigment pulverizing stone (S9:534).

### The conclusions

#### 1. The features of the lithic industries

Lithic raw materials at S9 are dominated by cherts, followed by quartzite. Most of lithic artifact remains original cortex. Our surveys suggest that the raw materials were procured from banks of the Yellow River. A few mudstone and sandstone have similar characters to the bedrocks alongside Qingshuihe River.

Lithic reduction technique at the site is represented by free-hand hammerstone percussion, followed by bipolar reduction. Tool manufactures and secondary retouch were processed by the pressure flaking technique through dorsal retouch. Stone tool assemblage was represented by small flake tools including scrapers, end scrapers, points and choppers. The combination of scrapers and end scrapers is comprised of 88.9% of total tool assemblage.

Lithic industry at S9 represents a small flake tool tradition in North China. However, the site yield typical micro-cores which represent micro-blade pressure technique at the site. Variety of micro-cores is present, indicative of Late Paleolithic microlithic tradition.

#### 2. The distribution, chronology and nature of the site

There are two layers of Heilu sediment in S9. The upper layer has relatively thick deposit about 2m, while the lower layer is about 0.3m. The survey indicates that such layers also appear alongside Qingshuihe River, but are more concentrated on areas near Gaolouhe Village. For example, the cultural remains from the S12G site were found from Heilu sediment, and are similar to those from S9. Similarly, ostrich eggshells were also found from Heilu sediment, corresponding to that at S9. Cultural remains at S12G are widely distributed and rich in contents. Thus cultural remains of the date of S9 at the end of late Paleolithic Age must have its distribution radiated from the center near Gaolouhe.

Charcoal samples were taken from the hearth in Layer



3 for AMS  $^{14}\text{C}$  dating, and the results show a date of  $8340\pm 130$  BP (BA02053). Samples from Layer 4 yielded dates of  $11600\pm 250$  BP (NZA34662) and  $12575\pm 180$  BP (NZA33542), while sampling date from Layer 5 is earlier than 13000 BP.

At S9, most lithic and bone artifacts were recovered in association with the hearth in Layer 3. The hearth is well preserved. Shell ornaments, ostrich eggshells and their byproduct were found, either through excavation or screening/sieving, from Layer 4, their manufacturing process are consistent in perforation; thus we can speculate these ornaments were produced by same group of people at the same period, who used the similar tools. Although there are not sufficient materials for lithic refitting analysis and a few of the lithic artifacts bore weathering pattern, we can suggest that S9 has been in primary context.

### 3. The significance of the discovery

The date of site, 13 to 8ka BP, fell in the transition from Pleistocene to Holocene, also a period of transition from Paleolithic to Neolithic Ages. Rich lithic artifacts, especially various micro-blades, provide new evidence for the study of Late Paleolithic lithic technology in North China. More importantly, shell and ostrich eggshell ornaments from the S9 are very similar, in terms of manufacturing process and forms, to that found in other sites in North China. This new evidence would shed new lights on cultural interaction and prehistoric ideology in North China.

Furthermore, all querns, grinding rollers and pigment fragments were found within 50cm sediments at S9, and

distributed within an area less than 2m radiation. The quern might have been used for pulverizing pigment (need to confirm through laboratory analyses). The worn surface can be determined as results of long-time paralleling grinding, by employing the rollers similar to those found at S9 (see above). The quern must also have been used for processing hard-husk typed grains. Therefore in-depth study at Shizitan S9 would provide substantial evidence including cultural materials and stratigraphic information for the study on origins of agriculture in North China.

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## Postscript

The original report written by Shi Jinming 石金鸣 and Song Yanhua 宋艳花 was published in *Kaogu* 考古 (Archaeology) 2010. 10: 7–17 with six illustrations, four tables and two pages of plates. This abridged version is prepared by Song Yanhua and translated into English by Chen Shen 沈辰.