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Con Moong Cave: A Stratified Late Pleistocene and Early Holocene Site in Northern Vietnam

Here, we outline the findings of comprehensive archaeological studies in Con Moong Cave, northern Vietnam, carried out by the Russian-Vietnamese Expedition, with the participation of Australian specialists, in 2010–2014. The cave is a stratified site, whose habitation deposits span a period beginning ca 42 ka BP. A detailed description of finds is provided. Diachronic changes in artifact types, use of raw materials, and technology are presented. Lithics from layers K–S represent the Early Upper Paleolithic Sơn Vi culture. Finds from layer K include core-shaped debris, flakes, and a discoidal side-scraper (or sumatralith). Tools were made on quartzite pebbles. Finds from layer L, dating to ca 36 ka BP, attest to substantial changes in the choice of lithic raw material: in addition to quartzite, mostly andesite and, less often, limestone, basalt, and certain sedimentary rocks were employed. Primary reduction was not preceded by preparation of nuclei. Flakes are large and medium-sized. Tools include a sumatralith and an end-scraper. The richest material comes from Con Moong layers Q and S, dating to 26–21 ka BP. Preforms consist of pebble cores with unprepared striking platforms. Nuclei include flat-parallel, radial, and irregular varieties. New tools in the assemblage include choppers, longitudinal and transverse convergent side-scrapers, and discoidal sumatraliths, as well as Hoabinhian axes and a unilateral axe (sumatralith). We conclude that archaeological remains from Con Moong Cave provide evidence of the evolution of the Sơn Vi culture from its emergence to its replacement by the Hoabinhian Technocomplex ~25 ka BP. Lithic industries from layers K and L correlate with one of the earliest stages in the peopling of this region by Homo sapiens.

Keywords: *Northern Vietnam, Con Moong Cave, Sơn Vi lithic industry, Sonvian, Hoabinhian, sumatraliths, paleoecology.*

Introduction

Vietnam is a unique region in Southeast Asia in terms of its peopling, the evolution of culture among its ancient human populations, and the development of humans and their cultures. Owing to the geographical proximity of its northern frontier to southern China, Vietnam likely constituted a transit zone for migrating ancient hominins during the period of Sundaland's existence (Fig. 1). This assumption is supported by the presence of Early Paleolithic sites yielding a bifacial industry, located in the central part of the country. In the vicinity of An Khê town in Gia Lai Province, the joint Russian-Vietnamese Archaeological Expedition has discovered more than 20 Early Paleolithic sites yielding a pebble-flake industry and bifacially flaked tools such as handaxes, which belong to the An Khê industrial complex (Derevianko et al., 2018). These sites include Roc Tung 1 and Go Da, with dates of 806 ± 22 and 782 ± 20 ka BP respectively, based upon $^{40}K/^{38}Ar$ assays of tektites found in the cultural layer associated with bifaces and pebble tools. These dates lead us to conclude that the Early Paleolithic An Khê culture in Vietnam existed simultaneously with the lithic industry found in the Baise Basin in southern China (Xie, Lin, Huang, 2003).

Later Paleolithic sites in Vietnam date to the beginning of the Middle Pleistocene (Davidson, Noble, 1992; Kahlke, 1965, 1973; Kahlke, Nguyen Van Nghia, 1965; Ciochon, Olsen, 1986; Olsen, Ciochon, 1990; Nguyễn Khắc Sử, 2007). Ten *H. erectus* teeth and dental remains of extinct great apes were discovered in Tham Khuyen and Tham Hai caves, in Lạng Sơn Province on Vietnam's Chinese border. The faunal remains found associated with this lithic complex mainly belong to extinct genera, such as *Ailuropoda*, *Stegodon*, *Pongo*, etc. The age of these sites is roughly 475 ± 125 ka BP (Marwick, 2009).

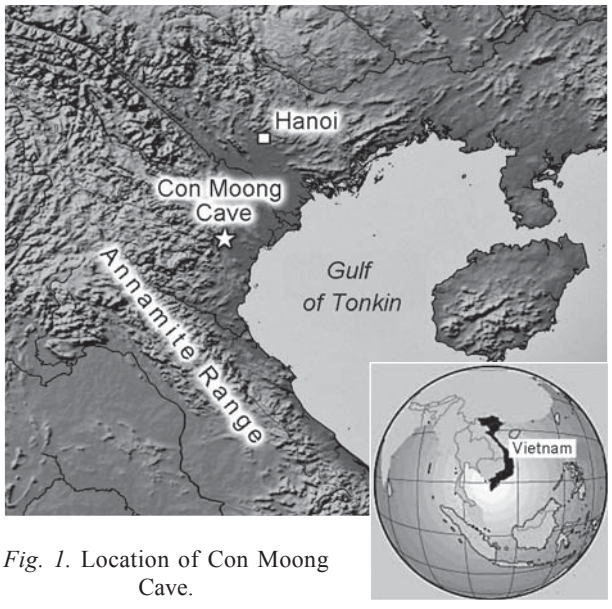

Fig. 1. Location of Con Moong Cave.

Artifacts found in Late Pleistocene sediments in northern Vietnam have been attributed to the Nguom, Sơn Vi, and Hòa Bình Paleolithic industries (ca 40–10 ka BP). Their main technical and typological features correspond with the Early Paleolithic of Vietnam, indicating diachronic continuity among Paleolithic traditions throughout the entire Pleistocene. The most representative industry in terms of chronology and geographical territory was the Sơn Vi lithic industry (Sonvian in Western literature). One of the key sites yielding evidence of Sơn Vi origins is Con Moong Cave. The purpose of this study is to present a detailed description, periodization, and chronology of archaeological evidence derived from that cave.

History of research in Con Moong Cave

Con Moong Cave (Hang Con Moong; 20°40′86.0″ N, 105°65′16.4″ E) is located in Cúc Phương National Park in Thanh Hóa Province, northern Vietnam (Fig. 2). This site, encompassing a total area of 230 m^2, was discovered in 1974 and investigated by Vietnamese archaeologists in 1975–1976 and 2008 (Nguyễn Khắc Sử, 2009).

The cave is located at an altitude of 147 m above sea level and 32 m above an unnamed seasonal watercourse flowing into Thanyen Creek, which subsequently joins the Bai River. The cave is in a limestone massif; the end of a mountain range stretching along the Su River; roughly 100 km west-southwest of Hanoi. This barrel-shaped cave has two connecting ingresses: a western entrance, 5.2 m wide and 6 m high, and a southeastern entrance, 5.2 wide and 6.2 m high.

Vietnamese scholars initially identified three cultural and chronological units in Con Moong Cave: Sơn Vi, Hòa Bình, and Bắc Sơn (Fig. 3) (Nguyễn Khắc Sử, 1977). The earliest deposits enclosing remains of the Sơn Vi culture occur at depths of about 3 m below the surface; their average thickness reaches 0.5 m. These strata are dark brown in color and contain whole snail shells, mainly of the species *Cyclophorus fulguratus*, *Camaena vayssierei*, and *Pollicaria crossei*. The artifact assemblage includes choppers, pebble fragments, retouched flakes, and animal bones with traces of processing. Stone tools of the Sơn Vi culture are dated to the Late Paleolithic (ca 17–14 ka BP).

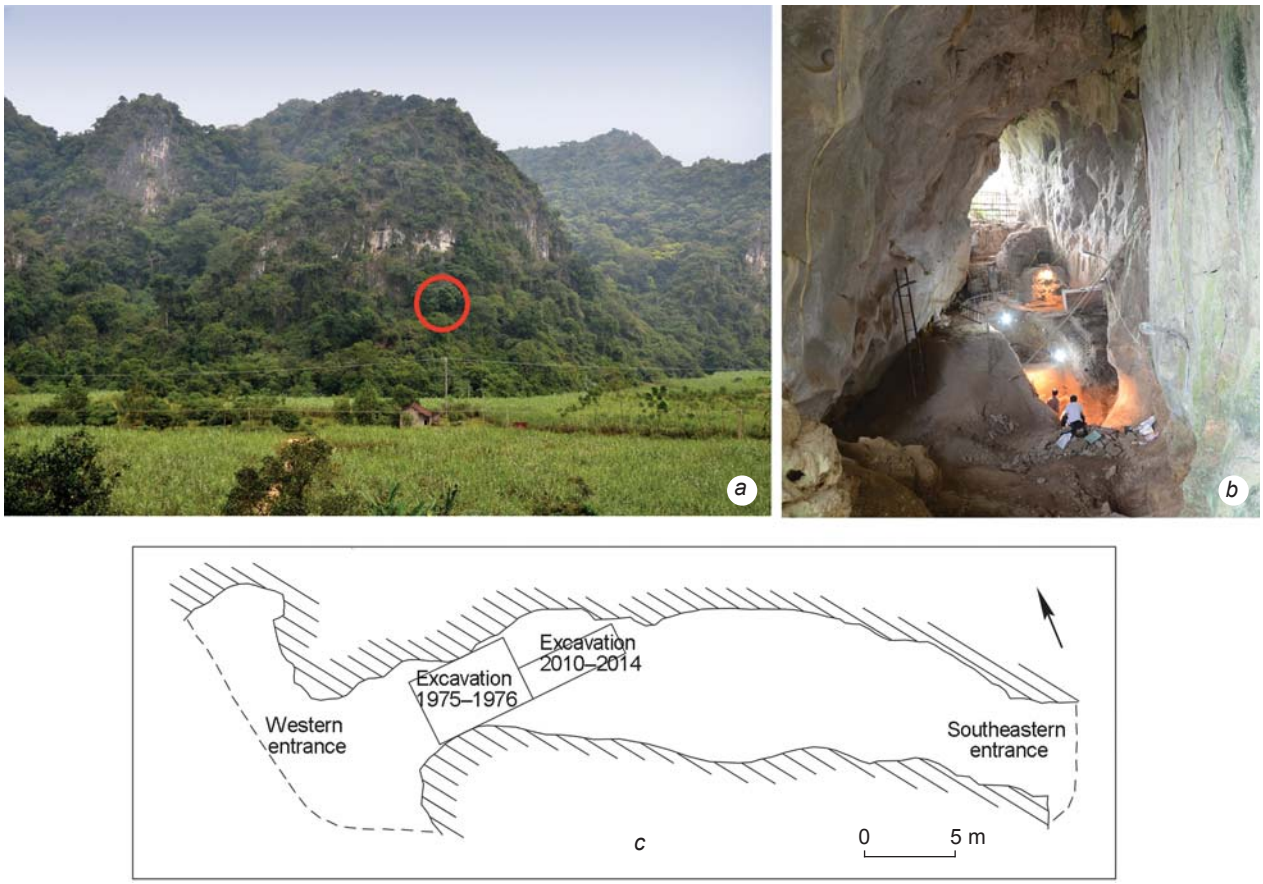

Fig. 2. Con Moong Cave.
a – general view of the massif indicating the location of the cave; *b* – western entrance of the cave; *c* – plan of the cave floor.

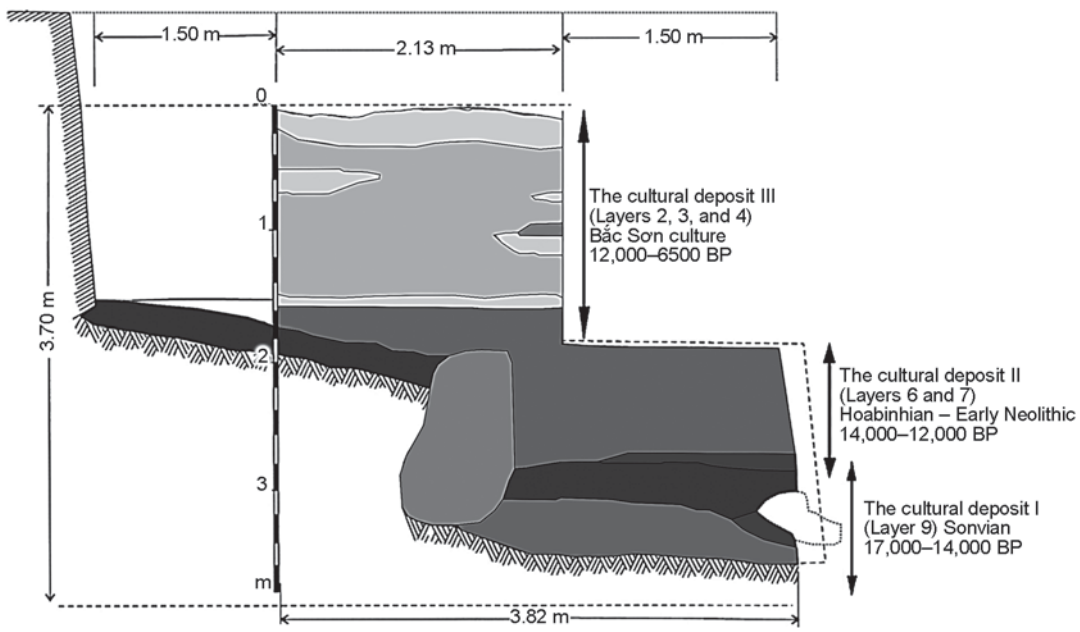

Fig. 3. Stratigraphy of deposits with chronological definitions in Con Moong Cave, based on the results of archaeological work conducted in 1975–1976 (after (Nguyễn Khắc Sử, 2009)).

In 2008, burials of a 25–30 year-old male and 40–50 year-old female were found in the cave. The height of the male was 1.75 m, that of the female 1.61 m; both individuals belonged to the Australo-Melanesian phenotype (Nguyễn Khắc Sử, 2009).

The deposits of the second cultural unit average 1.2 m thick, are blackish-brown in color, and are permeated with fragmentary gastropod shells, mainly of the genus *Cyclophorus*. This unit also contains remains of mollusks identified as *Antimelania swinhoei*, *A. siamensis*, *A. costula*, *Lanceolaria laevis*, *L. gray*, *L. frustorferi*, *Oxynaria diespiter*, *O.* sp. indet., and *Sinohyriopsis cumingii*. The species composition is diverse and includes preferential inhabitants of streams, mountain rivers, and marine environments. The burial of a 50–60 year-old man of Australo-Negroid phenotype was found in these sediments, containing pieces of ocher, stone tools, and oyster shells. The man was buried on his side with flexed legs. In contrast with the first cultural unit, the second contained amygdaloidal and discoidal sumatraliths, short and long axes, bone points, and side-scrapers made of shell. These artifacts are typical of the Hòa Bình culture at the Pleistocene-Holocene boundary (ca 14–9 ka BP) (Ibid.).

The third cultural unit in Con Moong Cave, averaging 1.2 m thick, was formed of limestone clay of various colors, ranging from brown in the lower strata to yellow in the upper layers, containing numerous intact and broken mollusk shells, mainly of the genera *Cyclophorus* and *Antimelania*. Three human burials were also discovered in this unit. The boundaries of the burials were unclear and the bones were very poorly preserved, making it impossible to establish the original position of the interred. All burials contained red ocher, stone tools, and oyster shell side-scrapers. These deposits, unlike the previous layers, contain stone axes with polished blades, sharpened bone points, oyster shell knives, and pottery. This archaeological complex is associated with the Bắc Sơn (or Bacsonian) cultural period (ca 9–7 ka BP) (Ibid.).

Hearths were identified in each cultural unit; their number increasing from bottom to top along the stratigraphic column. At the same time, their size decreased and their location shifted toward the cave entrance.

Unfortunately, the site's initial Vietnamese investigators present osteological evidence without division into cultural and chronological periods. It is clear that the Con Moong faunal complex comprises species typical of the tropical monsoon climate: *Rhinoceros* sp. indet., *Cervus* sp. indet., *Rusa unicolor*, *Muintiacus muntjak*, Bovidae gen. et sp. indet., *Capricornis sumatraensis*, *Macaca mulatta*, Sciuridae gen. et sp. indet., Canidae gen. et sp. indet., *Sus scrofa*, *Paradoxurus hermaphroditus*, *Anser* sp. indet., *Lophuru* sp. indet., and *Rattus* sp. indet. Bones were mostly fragmented and in some cases severely burned.

Research conducted at Con Moong Cave in 2010–2014

Archaeological investigations at Con Moong Cave were continued by the joint Russian-Vietnamese Expedition 2010–2014. An excavation area of 14 m^2 was established in the western entrance of the cave. The total thickness of unearthed sediments was 5.5–6.0 m. A specific feature of these deposits is their loose, sometimes calcified structure. They are composed of red-brown, in some places whitish, dust-like sandy loam, which was divided into 21 lithological layers. Large limestone ébolis occurs in the upper part of the deposits; their concentration decreasing with depth. The color of the deposits changes to gray-yellow directly at the contact of loose sediments and the cave's rocky base.

Joint Russian-Vietnamese investigations yielded 455 lithic and bone artifacts, unevenly distributed throughout the deposits. For the first time, radiocarbon and OSL dating of exposed sedimentary deposits, as well as micromorphological analysis of individual sections in the sedimentary column were conducted, making it possible to establish a chronological framework for sedimentation revealed by the 2010–2014 Con Moong excavations (Fig. 4) (McAdams et al., 2019). A series of chronometric dates obtained by specialists from the University of Wollongong (Australia) under the leadership of R. Roberts covers a range from 70 to 20 ka BP, and the results of micromorphological analysis of the deposits became the basis for reconstructing the evolution of natural and climatic changes during that period.

Assumptions regarding the habitation of Con Moong Cave by early humans during the Late Pleistocene were confirmed by analytical results of faunal remains (n=668) (Derevianko, Kandyba, Chekha, 2019; Derevianko et al., 2014). Osseous remains were found in layers V–H, but were not preserved in the lower layers. The degree of preservation of faunal remains decreased with depth; bones were severely fragmented, which complicated species identification; unidentifiable bones constituted a large proportion of the assemblage. Unfortunately, mineralization, leading

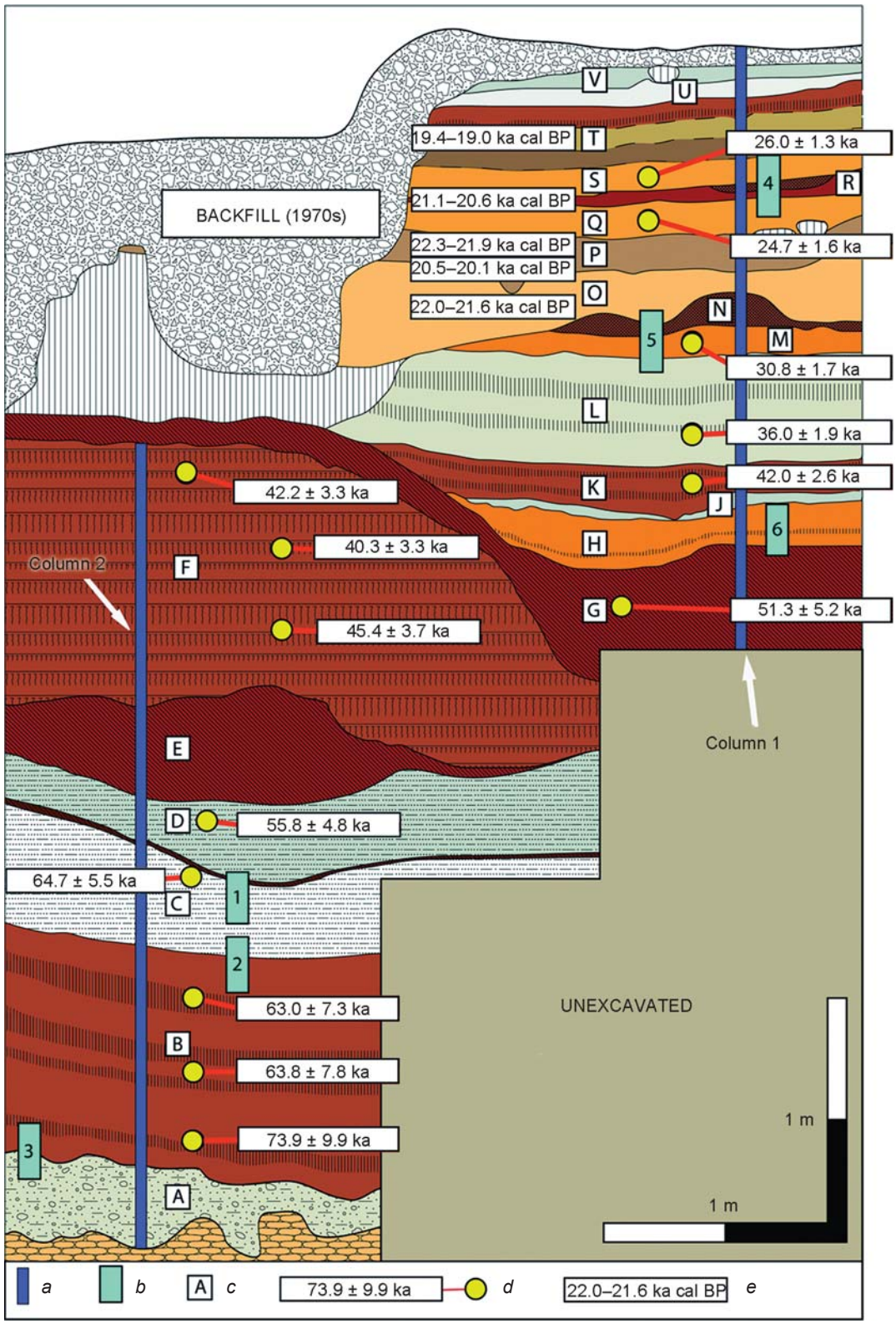

Fig. 4. Stratigraphy of deposits with chronological definitions in Con Moong Cave, based on results of archaeological work conducted in 2010–2014 (after (Nguyễn Khắc Sử, 2019)).

a – bulk sample column; *b* – micromorphology sample; *c* – lithostratigraphic unit; *d* – OSL age and sample position; *e* – ^{14}C age (charcoal and shell).

to decomposition of collagen, rendered osteological remains from layers L–H unsuitable for radiocarbon dating (McAdams et al., 2019).

Human bones (*n*=14) were found scattered in layers V, U, and T together with remains of large ungulates, carnivores, and primates (*Elephas maximus*, *Rhinoceros* sp. indet., *Ursus thibetanus*, *Rusa* sp. indet., *Muntiacus* sp. indet., *Bos* sp. indet., *Sus* sp. indet., *Hystrix* sp. indet., and *Macaca* sp. indet.). More than half of the recovered faunal remains were bones of artiodactyls (deer and wild boar). Fragments of smaller animals in these layers were significantly fewer than in the underlying layers; mainly bat remains were recovered.

A total of 144 bones were identified from layer S. The main difference between this horizon and the upper layers was the predominance of small mammals (30 %), birds (32 %), and turtles (14 %). Two fragments of human bone were also found here. Two animal bones exhibited traces of human processing. The most interesting find was the metapodial of a medium-sized cervid, from which a borer was fabricated. Several bone fragments, including a piece of elephant tusk, showed traces of fire modification.

The collection of lithic artifacts from layer S totals 253 items. The flake assemblage includes 243 specimens, of which 183 are medium-sized and small flakes. Faceting of dorsal surfaces of the flakes (predominantly parallel unidirectional and natural) is present in equal proportions. The collection contains two laminar flakes. The identifiable faceting of the dorsal surfaces of both artifacts is parallel and unidirectional. The residual striking platforms are natural in almost all flakes. The remaining 60 items in the flake industry are stone fragments, mostly medium-sized and small.

The toolkit comprises nine artifacts, including seven side-scrapers. The most numerous group, transverse convex side-scrapers, consists of five items (Fig. 5, *1*, *2*, *5*). Three of these tools were made on flat pebbles, and two on large, flat stone blocks. The working edge was created using direct percussion and finished by continuous scalar semi-abrupt medium- and small-faceted retouch. Two convergent convex side-scrapers were made on large flat pebbles by direct percussion and were finished by continuous scalar semi-abrupt retouch (Fig. 5, *3*, *6*). Two discoidal side-scrapers (sumatraliths) were made on pebbles (Fig. 5, *4*, *7*), their working edges shaped along the perimeter by continuous marginal retouch in one case, and invasive, scalar, semi-abrupt, medium-faceted retouch in the other. The toolkit also includes two retouched flakes.

Layer R yielded no lithic artifacts. The faunal collection from this stratum is small (*n*=61), half of which consisted of bird bones. One third of the bones belonged to artiodactyls.

Faunal remains increased sharply in layer Q (*n*=260), with ungulate bones prevailing (71 %), two-thirds of which derived from deer. A fragment of rhinoceros horn with traces of cuts was also found in this stratum.

The collection of lithic artifacts from layer Q includes 74 items. Primary reduction is represented by 14 cores and six core-shaped fragments. The collection also contains split pebbles and a hammerstone. Cores modified by parallel flaking total seven items (Fig. 6; 7, *1*). Removals were made across the long axis of the blank, which was a flat, massive, and large pebble, from unprepared striking platforms retaining natural cortex. Negative scars of large and medium-sized flakes were observed on the flaking surfaces. Radial cores total five specimens (Fig. 7, *2–4*). Removals were made along the perimeter of large pebbles, without preliminary preparation. In some cases, bifacial flaking was undertaken (Fig. 7, *5*, *6*). Two cuboid nuclei

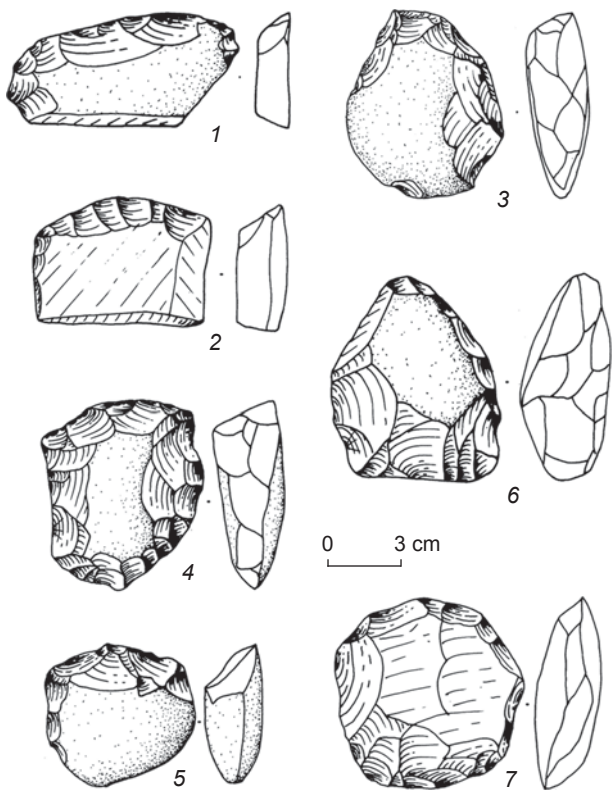

Fig. 5. Stone side-scrapers from layer S in Con Moong Cave. *1*, *2*, *5* – transverse-convex; *3*, *6* – convergent-convex; *4*, *7* – discoidal (sumatraliths).

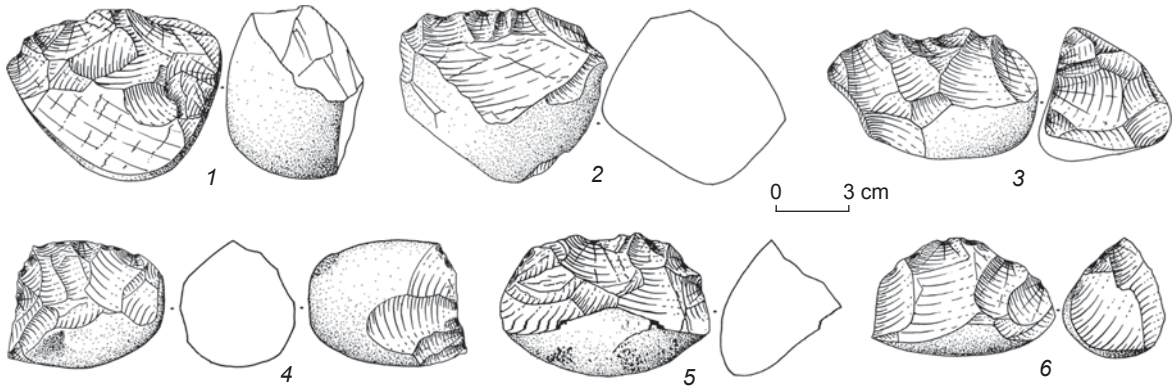

Fig. 6. Parallel reduction cores from layer Q in Con Moong Cave.

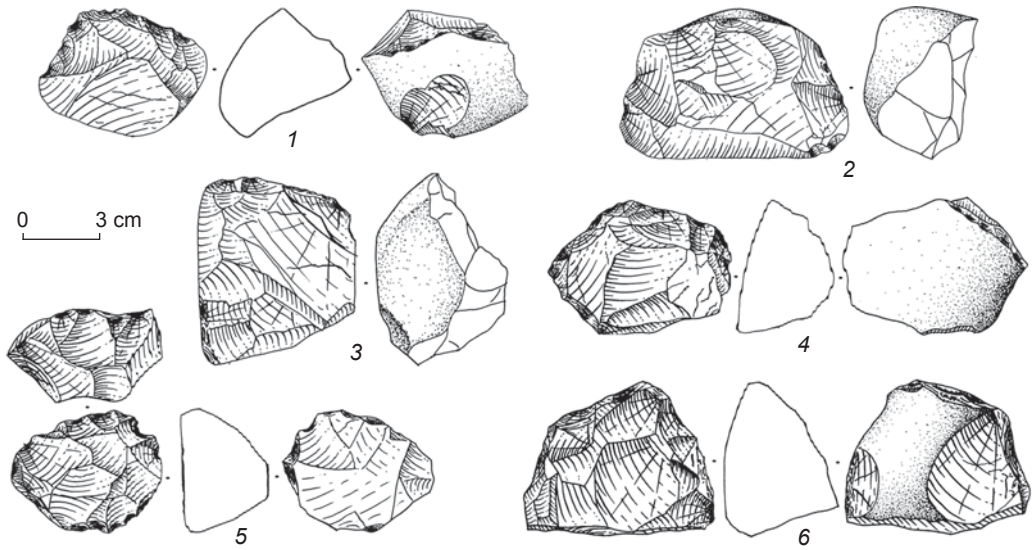

Fig. 7. Cores from layer Q in Con Moong Cave.
1 – parallel reduction; *2–4* – radial; *5*, *6* – radial-bilateral.

exhibiting irregular flaking patterns were discovered with multidirectional negative scars on their surfaces.

The flake assemblage comprises nine items: seven large flakes with natural residual faceting of their dorsal surfaces, and two fragments.

The toolkit (*n*=43) includes 10 choppers (Fig. 8). Large massive pebbles, mostly ovoid, were used in fabricating choppers. All the tools exhibit nearly right angles on their working edges, originally formed by direct percussion and additionally trimmed with scalar large- and medium-faceted retouch. Two chopping-tools were made on massive oblong pebbles, one of which was fragmented. The working edge in both cases was formed by bifacial direct percussion and in one case was trimmed with occasional scalar retouch.

The collection contains five Hoabinhian axes (Fig. 9, *1*, *3*). These tools are rectangular and plano-convex in cross-section. Most of the surfaces of two examples are covered with negative scars of shaping removals; edges were additionally trimmed with a series of small removals. The working edge on the third axe was formed only by small bifacial removals (Fig. 9, *4*). One axe that apparently did not receive its final shape belongs to this same group of tools (Fig. 9, *2*). Its working edge was made along 3/4 of the perimeter of a flat ovoid pebble by applying continuous semicircular, scalar, large-faceted retouch.

The layer Q assemblage includes 18 side-scrapers, among them six discoids or so-called sumatraliths (Fig. 10, *3*, *4*, *5*), three of which are fragmentary (Fig. 10, *1*, *2*). These artifacts were manufactured on large, flat pebbles. The tools achieved their round shape through the application of continuous abrupt, scalar, large-faceted retouch. Most such artifacts retain their natural cortex on the back side. Four transverse convex side-scrapers were found in layer Q

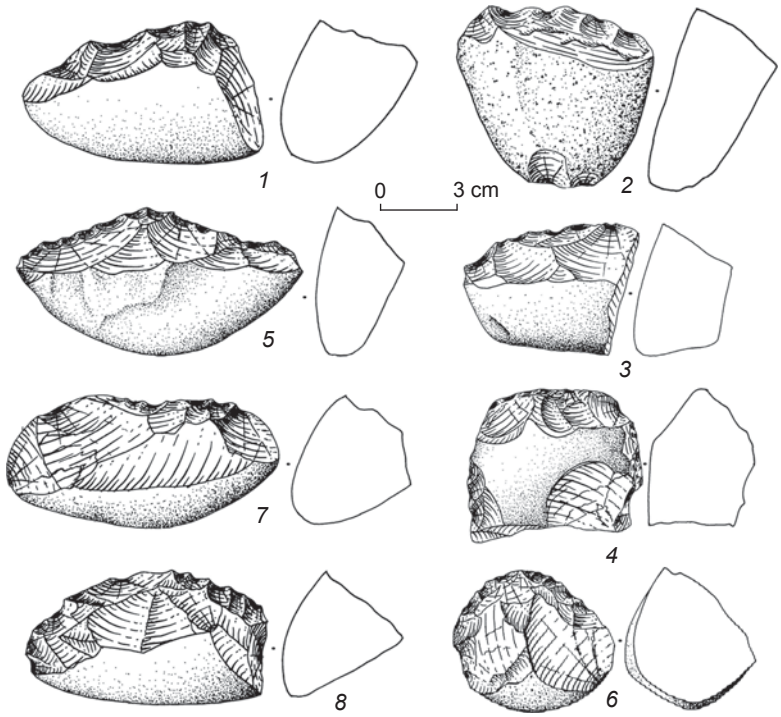

Fig. 8. Choppers from layer Q in Con Moong Cave.

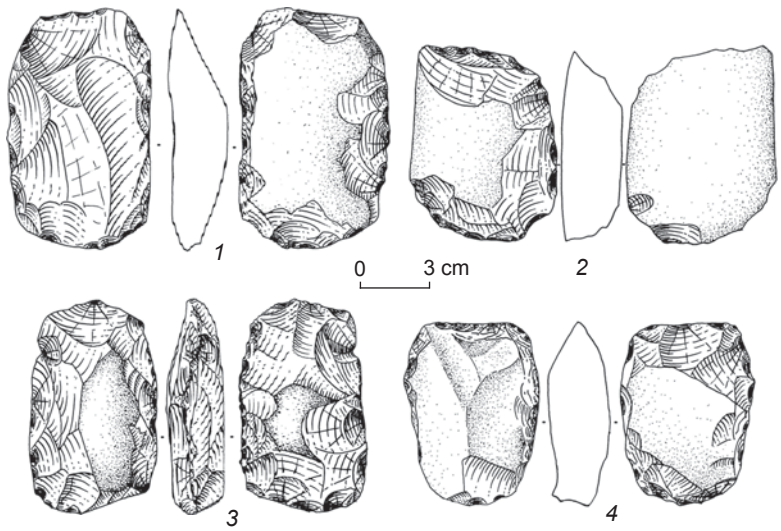

Fig. 9. Hoabinhian axes from layer Q in Con Moong Cave.

(Fig. 10, *6–9*); one of which was fragmentary (Fig. 11, *6*). They are morphologically similar to sumatraliths, but were mostly made on large primary spalls; one was fabricated on a flat pebble. Secondary flaking comprised applying continuous scalar, semi-abrupt retouch with medium-sized facets. Two convergent convex side-scrapers were made on large flakes by applying continuous scalar, semi-abrupt retouch to the ventral surface of the blank (Fig. 11, *8*). One convergent straight side-scraper was made on a massive flake (Fig. 11, *1*); its working edge was formed by continuous heavy, vertical, scalar retouch with medium-sized facets. A longitudinal straight side-scraper was made on a laminar flake; one of its edges was formed by continuous scalar semi-abrupt retouch (Fig. 11, *7*). One longitudinal convex side-scraper with ventral trimming was made on a large flake. The working edge was shaped by occasional scalar, semi-abrupt retouch (Fig. 11, *3*). A canted side-scraper was made on a large secondary spall (Fig. 11, *5*). Continuous scalar, large-faceted, semicircular retouch was applied to the ventral side of the blank. An ovoid pebble was used as a blank for a bifacial side-scraper (Fig. 11, *2*). Its straight working edge was initially prepared by removing a series of numerous small spalls and subsequently trimmed by continuous scalar retouch.

The layer Q lithic collection contains a notched piece made on a large flake, a backed knife fabricated on a medium-sized flake, four large spalls with retouch, and two pestles.

One item can be interpreted as the blank of a bilaterally flaked tool (Fig. 11, *4*). The edges on both sides of this triangular piece were partially treated with a series of small removals.

Seventy-four non-human bones were recovered from layer P, 40 of which belonged to deer and wild boar. No lithic artifacts were found in this stratum.

Layer O was the deepest lithological unit containing osteological evidence—47 specimens. Ten bones of these could not be meaningfully taxonomically identified because of their highly fragmented state. More than half of these osteological remains belong to ungulates. The collection contains the metatarsal bone of a sambar deer (*Rusa* sp. indet.) exhibiting artificial cut-marks.

The assemblage of lithic artifacts from layer O amounts to 42 items, including one pebble. The flake industry is represented by 41 items; 29 of which are intact, mostly of large and medium sizes. Dorsal trimming of flakes was predominantly parallel, unidirectional and parallel, bidirectional. Residual striking platforms generally retained their natural

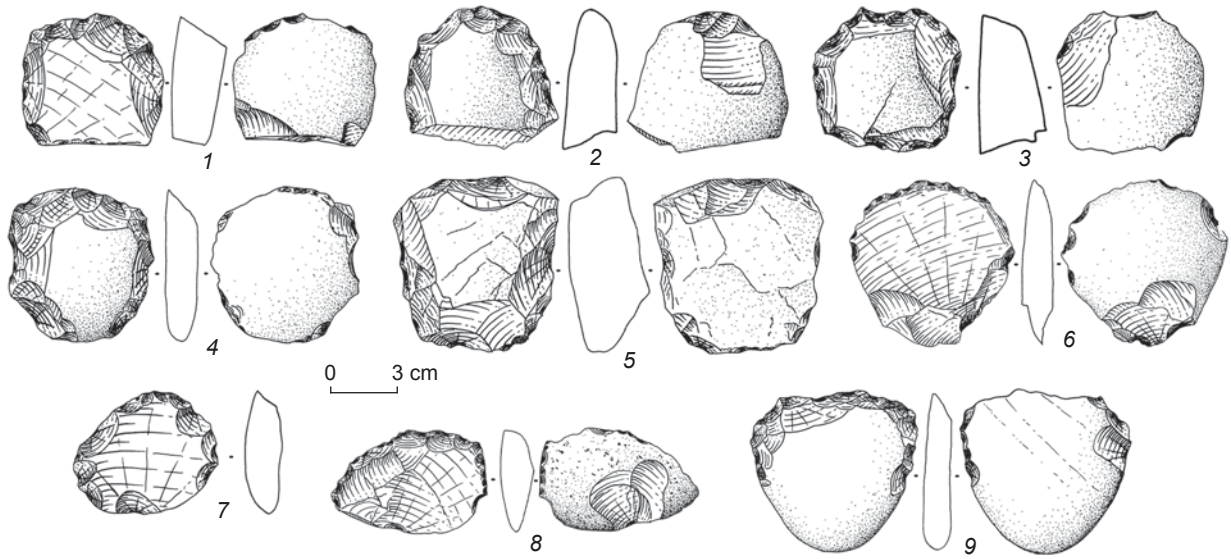

Fig. 10. Side-scrapers from layer Q in Con Moong Cave.
1–5 – discoids (sumatraliths); *6–9* – transverse-convex.

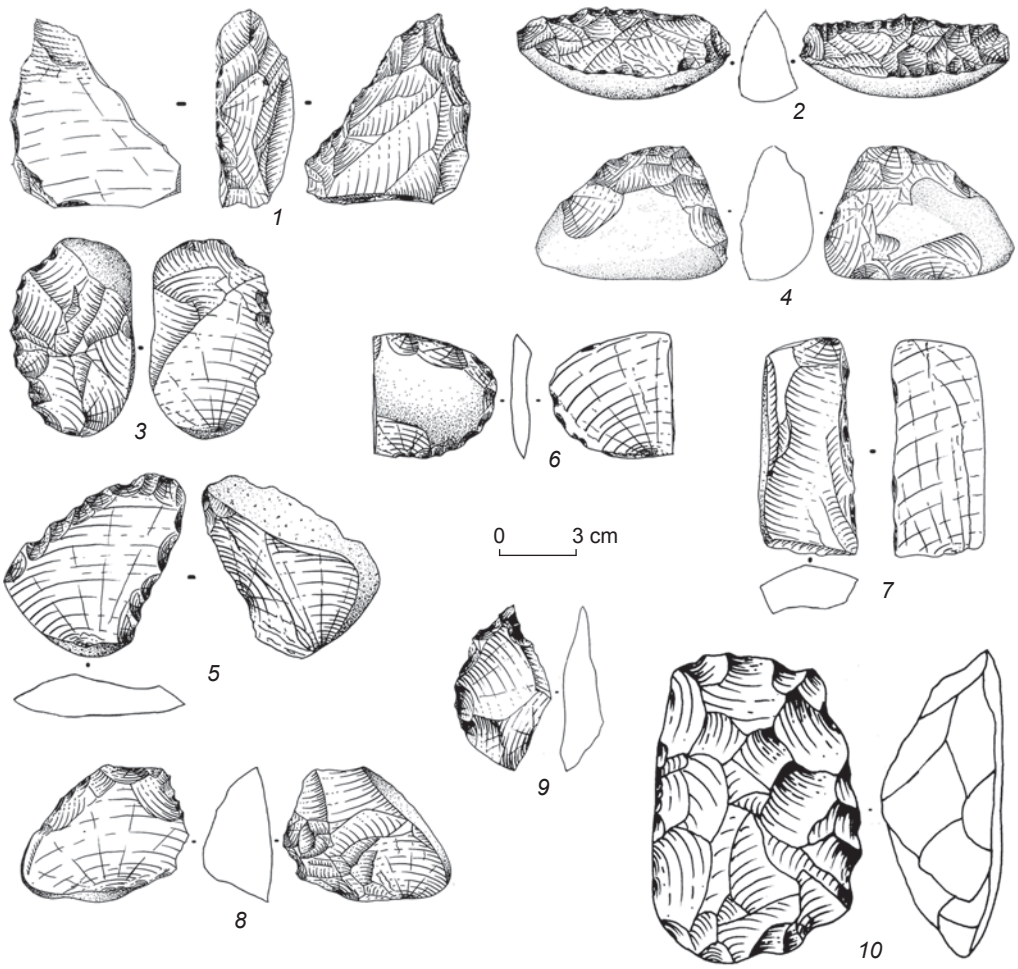

Fig. 11. Lithic artifacts from layers Q and L in Con Moong Cave.
1 – convergent straight side-scraper; *2* – bifacial side-scraper; *3* – longitudinal convex side-scraper; *4* – blank of a bifacially flaked tool; *5* – canted side-scraper; *6* – transverse convex side-scraper; *7* – longitudinal straight side-scraper; *8* – convergent convex side-scraper, *9* – denticulate end-scraper; *10* – sumatralith.

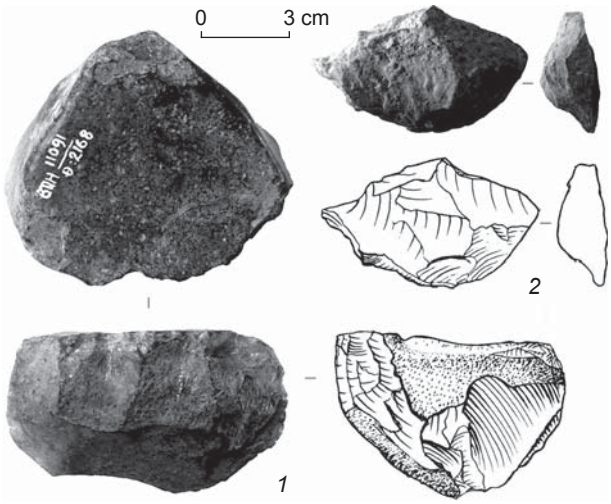

Fig. 12. Parallel reduction core (*1*) and flake (*2*) from layer L in Con Moong Cave.

surfaces. The rest of the items were medium-sized stone fragments.

Layer M yielded no archaeological evidence.

The collection of lithic artifacts from layer L includes 20 items. Primary reduction is represented by one nucleus, a large core-shaped fragment, and split pebbles. A pebble core modified by simple parallel flaking belongs to the initial stage of utilization (Fig. 12, *1*). Removals were made from its unprepared natural cortex surface across the long axis of the blank.

The flake industry is represented by 18 items; 14 of which are large and shortened flakes (Fig. 12, *2*). Dorsal trimming of flakes was predominantly parallel and unidirectional. Almost all residual striking platforms are natural. There are also four stone fragments in this assemblage.

The layer L toolkit consists of three items. One sumatralith was made on a nearly quadrangular pebble (see Fig. 11, *10*). Intense shaping of one plane of this blank was carried out through careful direct percussion and modification of the edge with small removals. A denticulate end-scraper was made on a flake fragment by denticulated retouch. A borer was made on a flake (see Fig. 11, *9*); its tip was created by removing several facets from a natural protrusion on the blank.

The collection of lithic artifacts from layer K includes six items. The process of primary reduction is represented by two core-shaped sub-triangular fragments of quartz bearing traces of removals.

The flake industry includes two artifacts: a medium-sized flake with a smooth striking platform and parallel, unidirectional dorsal faceting, and a medium-sized stone fragment.

The toolkit consists of two items. A discoidal side-scraper (sumatralith) was made on a quartzite pebble; its round shape was produced through continuous steep, scalar, large-faceted retouch. Natural cortex is preserved on the reverse side of this specimen. One end-scraper made on a large triangular quartz fragment exhibits marginal scalar, semicircular retouch.

Conclusions

Research carried out in Con Moong Cave in 2010–2014 has made it possible to establish the basic features its habitation by ancient humans. During the initial stages of deposition of soft sediments (layers A–E) under humid climatic conditions, the cave was inhabited by bats (McAdams et al., 2019). No lithic artifacts were found in layers A–E; thus, it can be concluded that during the period corresponding to the deposition of these deposits (ca 74–51 ka BP), Con Moong Cave was not utilized by ancient humans. Layer G was the first to contain remains of ash, which comprises indirect evidence of the presence of ancient humans in this shelter; all other evidence of human activities, including artifacts, is absent.

The beginning of human habitation in Con Moong Cave is established by evidence from the deposits of layer K, which were formed ca 42 ka BP. Here, quartzite pebbles were used as raw material for lithic reduction. The collection of stone tools is scarce, consisting of core-shaped fragments and debitage and, importantly, including tools such as discoidal side-scrapers (sumatraliths) typical of later periods.

The evidence from layer L, dating to ca 36 ka BP is also scant, but nonetheless reveals significant changes in the selection of lithic raw material. In addition to quartzite, andesite was used, and, slightly less frequently, limestone, basalt, and some sedimentary rocks. Notably, all blocks of raw material used by ancient humans at Con Moong came from alluvial deposits, as evidenced by the natural pebble cortex preserved on many artifacts. Primary reduction was not preceded by preparation of cores. Products of reduction were large and medium-sized flakes. The toolkit contained such types as sumatraliths and bone borers.

Lithic materials from layer O, which comprised only debitage (spalls, stone fragments, and split pebbles), testify to a continuing strategy of using various raw materials with a sharp decrease in the use of quartzite. Split bones of ungulates (deer and wild boar) discovered in layers O and P suggest that the

inhabitants of the cave specialized on hunting large mammals over a considerable period of time.

Layers Q and S, whose age has been established in the range of 26–21 ka BP, were the richest in archaeological materials. Techno-typological features appearing in the previous archaeological layers K, L, and O were most clearly manifested in layers Q and S. Andesite was the main raw material exploited in these layers; basalt, limestone, and quartzite were used much more rarely. Pebble cores were used as blanks. Reduction was not preceded by preparation of striking platforms, which is confirmed by the fact that the overwhelming majority of flakes retain their natural surfaces. Along with flat-parallel cores, the layers Q and S lithic collection contained radial and irregular cores. The toolkit became more diverse here; pebble tools such as choppers made their appearance. More types of side-scrapers were also identified. In addition to discoidal side-scrapers (sumatraliths), convergent, longitudinal, and transverse varieties were also found. Notably, the collection of axes included the Hoabinhian type (bifacially flaked) and a unifacial axe (sumatralith). A bone borer and two pestles testify to the beginning of intense visits to the cave by humans and permanent habitation there. Judging by abundant bone remains, the people associated with the material culture from layer Q actively hunted deer. This, most likely, led to the disappearance of deer in the vicinity of the cave, forcing its layer S inhabitants to prey on birds, turtles, and small mammals, including rodents. Among the finds from layers Q and S, noteworthy is a half-digested bone, which is very similar to bone remains regurgitated by hyenas. While hyenas are not represented in the modern fauna of Indochina, remains of *Crocuta* have been found in Late Pleistocene deposits in southern China. Several bones exhibiting traces of burning were split by humans, probably to extract bone marrow. Generally, the Con Moong faunal assemblage corresponds with that of Late Pleistocene Indochina. Human habitation of Con Moong Cave fits well the previously elaborated cultural and chronological sequence of the site; its materials significantly enrich the Late Pleistocene human history of the region.

The Vyunshau and Maze sites in Vĩnh Phúc Province, both yielding evidence of the Sơn Vi industry, are located on prominences covered almost completely with alluvial pebbles which are eroded areas of the third terrace above the flood plain of the Lower Middle Quaternary (Nguyễn Khắc Sử, 1982). According to their age, these hills in the Hanoi Depression occupy an intermediate position between the 25–35 m Lower Middle Quaternary terrace and the 5–8 m Upper Quaternary terrace. Therefore, the age of the surface on these hills can be dated to the QIII period, and these sites can presumably be attributed to the Final Pleistocene.

The results of this study confirm the conclusions of Vietnamese archaeologists (Ha Van Tan, 1971, 1997; Ha Van Tan et al., 1999) who regarded the Sơn Vi culture as a Late Pleistocene phenomenon immediately preceding the Hòa Bình technocomplex seem convincing. The evidence from Con Moong Cave makes it possible to trace the natural history of northern Vietnam over the past 70,000 years, and to establish one of the earliest stages in the emergence of modern human populations in the region.

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