NEW DATA ON THE HOABINHIAN: INVESTIGATIONS AT HANG CHO CAVE, NORTHERN VIETNAM

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ABSTRACT

A small-scale archaeological testing in Hang Cho Cave in 2004 and 2006 revealed 16 Hoabinhian levels. A total of 44 radiocarbon dates were obtained from these levels, ranging between ca. 19,500 and 8400 BP. They indicate that the Hoabinhian was already established in northern Vietnam by 20 kya. Another date of 29,140±200 BP from an unexcavated layer below them and five C14 dates from Hang Muoi suggest an even earlier appearance of the Hoabinhian. The lithic assemblage includes not only large, heavy tools but also clearly definable small tool types such as scrapers and burins. Variation in the sizes of flakes decreased through time.

INTRODUCTION

In the 1920s, archaeologists noticed the occurrence of a stone tool assemblage in the northern part of Vietnam, especially in Hoa Binh province. From a number of cave and rock shelter sites, there were reported lithic assemblages with characteristic stone tools. The name 'Hoabinhian' was given to designate these assemblages (Colani 1927). Soon, similar assemblages were found both in Thailand and southern China, and the Hoabinhian was recognized as representing an archaeological entity of the terminal Pleistocene and early Holocene in Southeast Asia. Today, the Hoabinhian is known to have been associated with a hunting and gathering mode of subsistence (Higham 1989, 2002; Moser 2001).

The Hoabinhian has attracted archaeological attention since the 1960s as a potential candidate for an independent origin of agriculture. It was suggested by the 1970s that agriculture began independently in Southeast Asia during the Hoabinhian, as a result of intensive gathering of wild plant resources (Gorman 1970, 1971, 1977; Solheim 1972). The suggestion was accepted widely at that time, but since the 1980s the validity of the argument has been questioned (Higham 1995). This is especially so for regions outside the core area of northern Vietnam.

In Vietnam, Hoabinhian sites are mainly caves and rock shelters in the intermontane valleys close to Thailand and China (Institute of Archaeology 2001). Recent investigation of ten or so sites by the Vietnamese Institute of Archaeology has provided new data on the Hoabinhian. While this evidence mainly supports the traditional view that the Hoabinhian was based on hunting and gathering, the discovery of charred rice grains in some sites has reignited discussion on the issue of the origins of agriculture in Southeast Asia (Dao 2001; Vo 2001). Nevertheless, there is still a lot to be desired in our understanding of the Hoabinhian in northern Vietnam. Information is rather limited and fragmentary, and most of the available literature does not provide satisfactory descriptions of either stratigraphy or the contents of assemblages. Moreover, in the absence of reliable chronometric data for most sites, little progress can be expected in Hoabinhian research (Nguyen and Pham 2001).

To help to rectify current shortcomings, the authors initiated research in Hoa Binh province in cooperation with Vietnamese colleagues. This research has aimed at an improved chronometric control and understanding of Hoabinhian assemblages. During eight visits over a period of four years, chronometric samples have been collected from various Hoabinhian localities. In addition, samples from other periods were provided by Vietnamese colleagues. In the end, a total of more than 200 chronometric samples has been dated at the Seoul National University AMS laboratory, and some of the results were published in Korean in Yi et al. 2004, 2005a and 2005b.

During our fourth and seventh visit in early 2004 and late 2006, excavation was undertaken at the site of Hang Cho. This report describes the findings. Although small in scale, interesting results were obtained, and the 44 AMS dates make it clear that the Hoabinhian is much older than previously considered.

INVESTIGATIONS AT HANG CHO

Hang Cho is located at 20°50′07″ N and 105°39′08″ E in Hui hamlet of Cao Ram commune in Luong Son District, Hoa Binh Province, about 40 km from the Hanoi city limit as crows fly (Fig. 1). The area has a tower karst geomorphology with many cliffs over 100 m high (Demeter et al. 2005; Martini et al. 1998). A number of caves and rock-shelters have formed at the bases of the cliffs, many with archaeological evidence pertaining to the Hoabinhian. Hang Cho is one of the largest among them (Fig. 2).

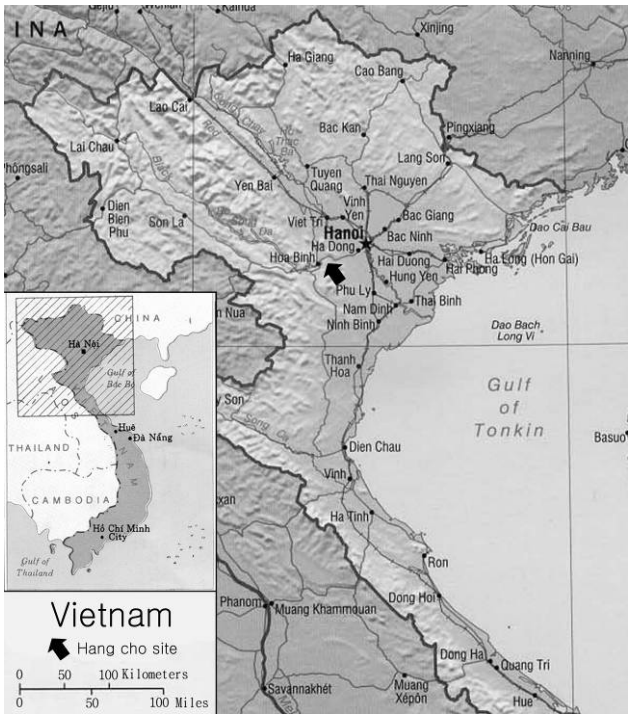


Figure 1. Location of Hang Cho site

Figure 2. Hang Cho cave from a distance

As seen in Fig. 2, a relatively wide floodplain occurs in front of Hang Cho cave, about 10 m below the cave floor. Along the base of the cliff, pockets of fluvial gravel occur between the cave and the floodplain. Today, there is an active stream channel about 150 m from the cave, but a dried-up channel can be seen immediately in front of it. Remnant pockets of shell layers are cemented to the walls and ceiling of the cave.

Currently, the deposits inside Hang Cho cave are about 0.5 to 1 m thick, rich with molluscan and mammalian fossils (Figs 3 and 4). The fauna is known to be of Middle to Upper Pleistocene or Holocene age (Bacon et al. 2004). The name of the site literally means a cave of shells in Vietnamese. It is said that the original deposit was much thicker once than now. When the cave was

Figure 3. Section 3 of Hang Cho cave

Figure 4. Shell-rich layers at Hang Cho

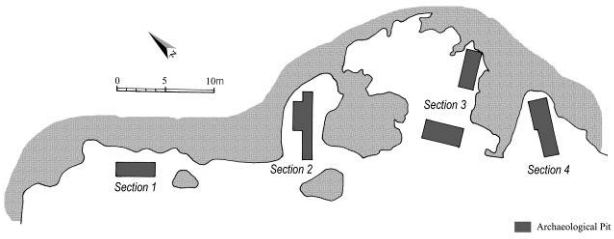


Figure 5. Plan of the excavated areas in Hang Cho cave

visited by Yi in 2001, virtually all of the deposit in the front of the main cave had been removed (Fig. 3) for fertiliser.

The excavation at Hang Cho in 2004 was an international effort. There were four separate teams of Vietnamese, Koreans, Japanese and Australians. While the Vietnamese and Koreans were looking for archaeological evidence, the Japanese and Australians were researching human remains. Each team took charge of a separate part at the cave, and the part tested by the Koreans was termed Section 3.

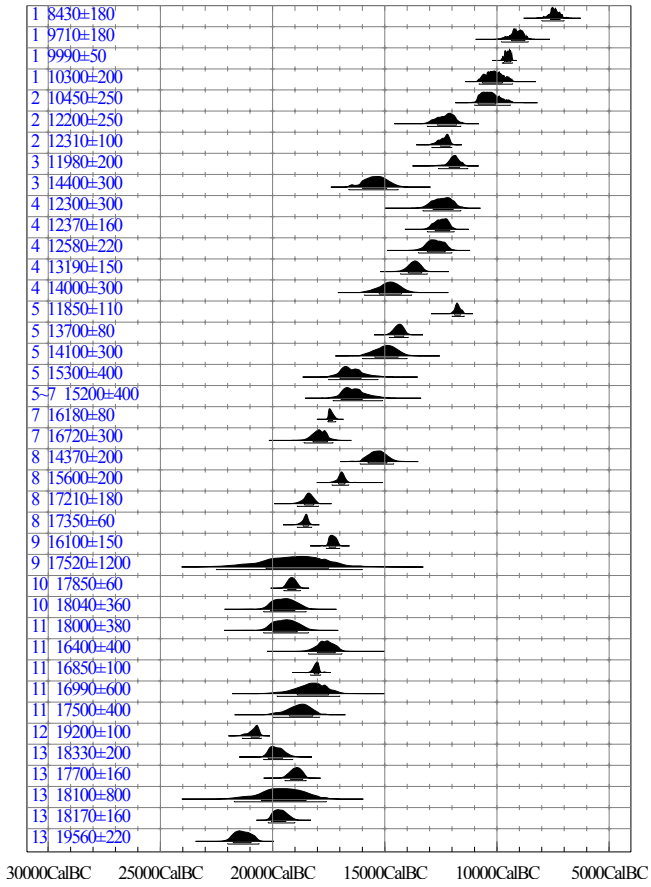
In 2006, further excavation continued for 15 days in December. Three more Hoabinhian layers were found below the previously discovered ones and the existence of an even older layer was confirmed. But only a limited amount of archaeological data was retrieved (Yi et al. in press).

Table 1. AMS dates from Hang Cho

Layer	Sample no.	Material	C-14 Age	OxCal v.3.10
1	SNU 04-A011	Shell	8.430±180	8.000~7.000
	SNU 03-137	Shell	9.710±180	9.800~8.600
	SNU 03-131	Shell	9.990± 50	9.760~9.310
	SNU 03-130	Shell	10.300±200	10.800~9.300
2	SNU 03-156	Charcoal	10.450±250	11.000~9.400
	SNU 03-132	Shell	12.200±250	13.100~11.600
	SNU 04-A012	Shell	12.310±100	12.900~12.000
3	SNU 04-A013	Shell	11.980±200	12.600~11.300
	SNU 03-133	Shell	14.400±300	16.600~14.400
4	SNU 04-222	Charcoal	12.300±300	13.300~11.600
	SNU 04-A014	Shell	12.370±160	13.100~11.900
	SNU 03-158	Charcoal	12.580±220	13.500~12.000
	SNU 03-157	Charcoal	13.190±150	14.300~13.100
	SNU 03-134	Shell	14.000±300	15.900~13.800
5	SNU 04-A015	Shell	11.850±110	12.000~11.450
	SNU 03-136	Shell	13.700± 80	14.800~13.950
	SNU 03-135	Shell	14.100±300	16.000~14.000
	SNU 04-221	Charcoal	15.300±400	17.500~15.300
6~7	SNU 04-223	Charcoal	15.200±400	17.300~15.100
7	SNU 04-224	Charcoal	16.180± 80	17.540~17.180
	SNU 04-A016	Shell	16.720±300	18.600~17.300
8	SNU 04-A017	Shell	14.370±200	16.100~14.600
	SNU 04-225	Charcoal	15.600±200	17.350~16.600
	SNU 04-226	Charcoal	17.210±180	18.900~17.950
	SNU 04-A018	Shell	17.350± 60	18.900~18.250
9	SNU 04-227	Charcoal	16.100±150	17.600~17.000
	SNU 04-A019	Shell	17.520±120	22.500~16.000
10	SNU 04-228	Charcoal	17.850± 60	19.500~18.750
	SNU 04-A020	Shell	18.040±360	20.400~18.500
11	SNU 04-A021	Shell	18.000±380	20.400~18.400
	SNU 04-A022	Shell	16.400±400	18.400~16.900
	SNU 04-230	Charcoal	16.850±100	18.310~17.860
	SNU 04-A023	Shell	16.990±600	19.800~17.000
	SNU 04-229	Charcoal	17.500±400	20.000~17.900
12	SNU 04-A024	Shell	19.200±100	21.350~20.500
13	SNU 04-A025	Shell	18.330±200	20.400~19.100
	SNU 04-232	Charcoal	17.700±160	19.450~18.500
	SNU 04-A026	Shell	18.100±800	21.700~17.600
	SNU 04-233	Charcoal	18.170±160	20.200~19.000
	SNU 04-A027	Shell	19.560±220	22.000~20.600

Testing was conducted for 12 days from late January to early February 2004. Facing west, Section 3 is the main chamber of the Hang Cho cave system (Fig. 5), which consists of two parts (Fig. 6). The main, outer part is where the archaeological deposit lies. While two pits were excavated (Fig. 6), it was soon revealed that the one in the entrance area of the cave was heavily disturbed. In the other, there was a preserved 4 by 1.6 m area of deposit left intact towards the inside of the cave. A total of 13 depositional units were recognized here (Fig. 7).

Table 2. Calibrated AMS dates from Hang Cho



Stratigraphy and Chronology

From a geological point of view, the stratigraphic units defined at Hang Cho consist of freshwater molluscan shells and weathered limestone blocks mixed with various archaeological materials such as stone and bone tools and bone fragments. However, the midden beds have little soil matrix and the gastropod shells are loose, suggesting that deposition occurred rather 'recently'. The midden layers are separated by thin layers of weathered soil. Concentrations of charcoal and/or stone tools are also observed at interfaces, indicating human occupation. Thus, while it is sometimes difficult to delineate stratigraphic units within shell-rich deposits, in this case most of the units were defined with ease.

Although shells are the most important components of the deposit, the degree of concretion is lowest at the bottom and highest in the middle. In addition to shells and artifacts a number of bone fragments were found, too fragile and fragmentary to attempt a meaningful quantification. Nevertheless, it appears that layers 13 to 11 were rich with remains of large mammals such as bovids and bears, along with medium-sized species of deer, pig, wolf and cat, as well as fish and tortoise. Large species were not seen in the middle part of the deposit, but appear above Level 5. Molars of *Stegodon* sp. were recovered from disturbed portions of the deposit. Also, part of a

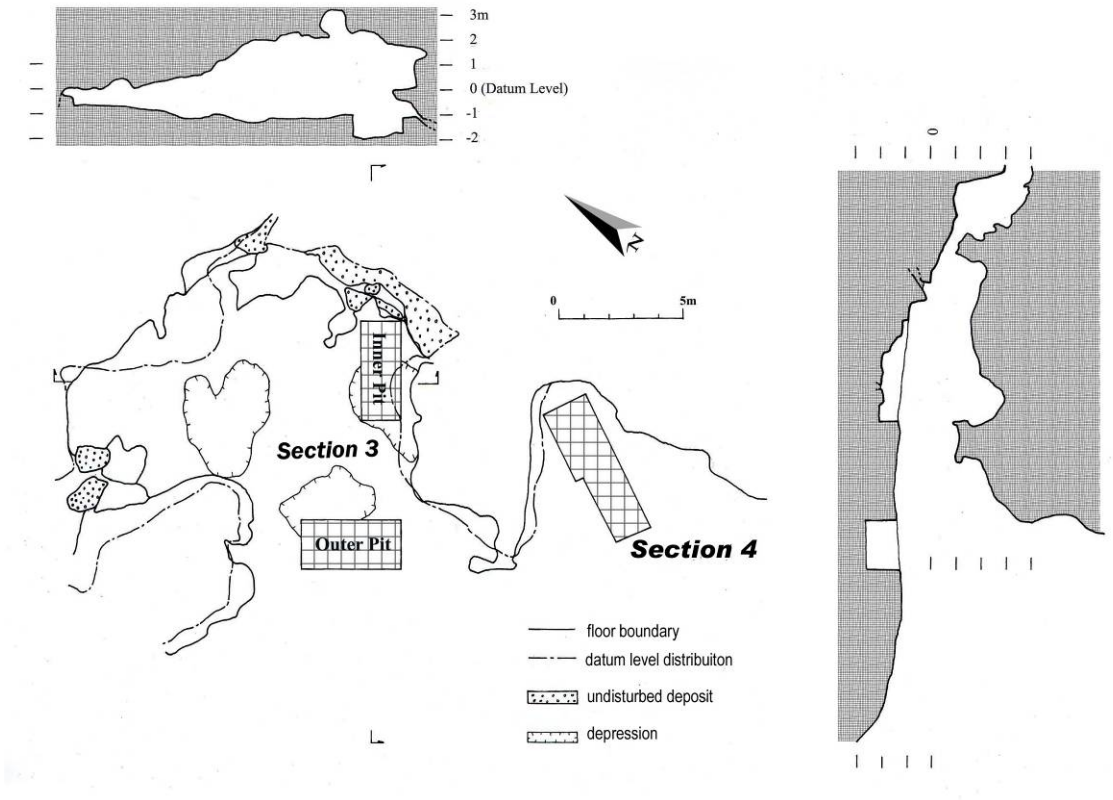


Figure 6. Plan of Section 3 (2004)

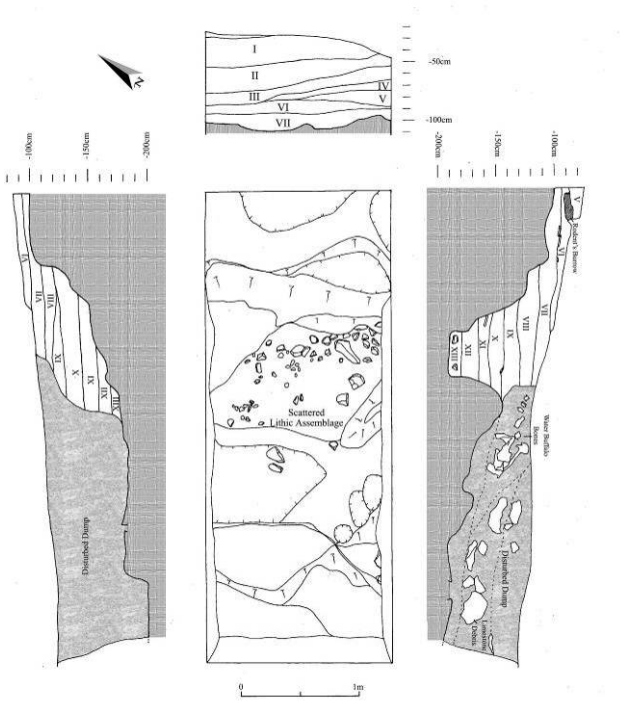


Figure 7. Stratigraphy of Section 3 (2004)

human left mandible was found in layer 6, and the proximal end of a femur in layer 10.

40 AMS dates were obtained from the stratigraphic units, from earlier surveys and excavation in 2004, all of which proved to be in good stratigraphic order (Tables 1 and 2). The oldest date of 19,560±220 BP was obtained from the lowermost bed, while a date of 8430±180 BP from the topmost layer represents the youngest. As their calibrated ages range between c. 22,000 and 7000 BC, the excavated deposit could have formed over a period of about 15 thousand years. What is more significant than the mere ages of the samples is that dates from both shell and charcoal samples are not different, which increases the reliability of the results and suggests that the freshwater shell dates are not contaminated by inert carbon from the geological limestone environment.

Moreover, the beginning of the Hoabinhian in northern Vietnam might be earlier than even these dates. At Hang Muoi, about 10 km from Hang Cho, dates of 18,430±160 BP (SNU04-A006 shell), 18,740±160 BP (SNU04-A009 shell), 19,470±250 BP (SNU04-A007 shell), 19,720±150 BP (SNU04-A008 shell), and 20,750±80 BP (SNU04-A050 charcoal) were obtained from confirmed Hoabinhian layers (Yi et al. 2004).

But the oldest date for the Hoabinhian was obtained at Hang Cho in 2006. At the end of the excavation, a calcareous concretion was found beneath the Hoabinhian layers. To verify the presence of earlier layers below, a small area measuring 30 by 30 cm was cut through the concretion. Below it, a flake and charred bone fragments were retrieved. A charcoal sample produced a C14 date of

29,140±200 BP (SNU07-223), which suggests a human presence in the cave around 30,000 years ago

In addition to the above dates, three more were obtained in 2006. A date of 18,570±80 BP (SNU07-222) was obtained from charcoal fragments scattered in layers 14 and 15, while layer 16 produced a date of 18,600±200 BP (SNU07-220 charcoal). The third date, of 17,910±80 BC (SNU07-224 charcoal), came from a shallow depression below layer 7. When calibrated, these three dates range between 20,410 and 20,040 BC, 20,600 and 19,400 BC, and 19,600 and 18,800 BC respectively at the 95.4% probability level.

In other parts of the cave, i.e., Sections 1, 2 and 4, the Hoabinhian deposit was only poorly preserved. In Section 1, a late Hoabinhian layer was found below the Phung Nguyen Neolithic layer. Two charcoal samples from the Hoabinhian layer were dated 9360±40 (SNU 04-235) and 8790±40 BP (SNU 04-241). At the 95.4% probability level, they calibrate to between 8750 and 8490 BC and 8170 and 7670 BC respectively, the youngest dates for the Hang Cho Hoabinhian. In Section 2, an AMS date of 11,400±200 BP (SNU 04-241) from a piece of charcoal was obtained from the bottom of the excavation pit in association with a Hoabinhian stone tool. The calibration for this date ranges between 11,750 and 10,950 BC at the 95.4% probability level. However, the layer appears to be redeposited. Finally, in Section 4, a relatively intact Hoabinhian occupation layer was found with a hearth, stone tools, animal and human bones. Two AMS dates were obtained, one on charcoal being 13,110±60 BP (SNU 04-245). This calibrates between 13,950 and 13,200 BC at the 95.4% probability level. Another shell date is 14,900±160 BP (SNU 04-A028). Thus, the layer seems to correspond chronologically to Layers 4 and/or 5 in Section 3.

The Depositional Environment in Hang Cho

If the site had been formed over a period longer than 10,000 years, deposition should have occurred under very different conditions from time to time. The very existence of shell beds inside the cave, especially those adhering to the ceiling, indicates that some time ago the cave was completely filled with such a deposit that has since been washed out. As mentioned above, the stratigraphy of the surviving deposits demonstrates shell-bearing layers separated by weathered surfaces and clean soil. These soil layers suggest that introduction of midden materials into the cave was a punctuated process.

Most of the molluscan shells are gastropods, mainly Melanoides tuberculata, family Thiaridae, that make up more than 90% of the total remains in the deposit. The rest are Planorbidae and Viviparidae, and Lamellidens sp. bivalves. For radiometric dating, only shells of Melanoides tuberculata were taken as samples. This species has a spire about 50 mm in length with many suture lines, and inhabits low energy zones such as river banks. X-ray diffraction analysis of the Melanoides shells reveals that all are aragonite. This is significant because aragonite becomes unstable under the influence of fresh water and can be replaced by calcite. If this happens, the original micro-structure of the shell can be distorted (Kennedy and Taylor 1968). However, in the case of Hang Cho, all the gastropod shells are aragonitic in mineralogy with well-preserved micro-structures.

Assemblage Composition (Figs 8-11)

Figure 8. Choppers from Hang Cho

Figure 9. Hand-adze from Hang Cho

Table 3. Morphological attributes of flakes

Layer	Number of flakes	Length (cm)			Width (cm)			Striking platform thickness (cm)		
		mean	SD	CV(%)	mean	SD	CV(%)	mean	SD	CV(%)
1	11	3.34	0.633	19.0	3.27	0.697	21.3	0.46	0.262	57.0
2	8	3.79	0.940	24.8	4.14	0.848	20.5	0.43	0.311	72.3
3	8	3.46	0.924	26.7	3.86	0.886	23.0	0.56	0.262	46.8
4	4	2.68	0.403	15.0	3.53	0.499	14.1	0.40	0.216	54.0
5	1	3.60	0	0	4.20	0	0	0.70	0	0
6	5	4.82	1.672	34.7	4.28	1.377	32.3	0.76	0.134	17.6
7	8	4.35	1.060	24.4	4.75	1.288	27.1	0.66	0.307	46.5
8	26	3.92	1.124	28.7	4.66	1.433	30.8	0.53	0.238	44.9
9	6	4.40	0.851	19.3	4.25	0.641	15.1	0.62	0.354	57.1
10	12	3.53	0.798	22.6	4.42	1.259	28.5	0.43	0.196	45.6
11	5	3.52	1.040	29.5	3.90	0.604	15.5	0.36	0.152	42.2
12	5	4.30	0.682	15.9	4.06	1.078	26.6	0.86	0.344	40.0
13	18	3.63	0.995	28.2	4.06	1.420	35.0	0.58	0.312	53.8

Figure 10. Scraper from Hang Cho

Figure 11. Burins from Hang Cho

Descriptions of the Hang Cho assemblage have already been published in Korean (Yi et al. 2005a, b; in press), and here we present two of the most salient aspects of the assemblage. One is that, despite the expected dominance of large heavy-duty tools, there do appear small tools, although limited in quantity. Fig. 10 shows a well-defined end-scraper, while Fig. 11 shows two small pieces with a burin blow at one end. A total of 23 small tools were counted, most from upper layers. Compared to the large tools, standardized shaping is virtually non-existent. The small number and generally irregular shapes of these small pieces suggest opportunistic tool-making.

In 2004, a total of 117 debitage flakes were observed (Table 3). In general, flakes from the upper layers tend to be more elongated and smaller than those in the lower. While it was impossible to define any pattern in morphological changes in the flakes through time, mean values for flake length and width became slightly smaller in the upper layers, as did their standard deviations and coefficients of variation (CV). This might indicate a trend towards more standardized production.

CONCLUDING REMARKS

Excavation at Hang Cho cave provided chronometric data which indicate that the Hoabinhian in northern Vietnam was already in existence about 20,000 years ago. It is expected that still older dates will be obtained from units lying below the test pit. While insufficient observation has been made on the excavated samples, the importance of large tools is readily visible, but small tools were also present. It is expected that more information will be available from new testing planned for the future.

ACKNOWLEDGEMENT

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REFERENCES CITED

Bacon, A., et al. 2004. The Pleistocene Ma U'Oi cave, northern Vietnam: palaeontology, sedimentology and palaeoenvironments. *Geobios* 37: 305-314.

Colani, M. 1927. L'âge de la pierre dans la province de Hoa Binh, Tonkin. *Mémoires du Service Géologique de l'Indochine* XIV: 1.

Dao Quy Canh. 2001. About agriculture of Hoa Binh Culture in Vietnam. In Institute of Archaeology (ed.), *International Conference on One Century of Vietnam Archeology: Achievement, Orientation and Prospect*. Mimeograph. Hanoi: Institute of Archeology, National Centre for Science and Humanities. (In Vietnamese with English abstract).

Demeter, F., et al. 2005. Discovery of a second human molar and cranium fragment in the late Middle to Late Pleistocene cave of Ma U'Oi (Northern Vietnam). *Journal of Human Evolution* 48: 393 - 402.

Gorman, C.H. 1970. Excavations at Spirit Cave, North Thailand: Some Interim Interpretations. *Asian Perspectives* 13: 79-10

Gorman, C.H. 1971. The Hoabinhian and after: subsistence patterns in Southeast Asia during the Late Pleistocene and Early Recent periods. *World Archaeology* 2(3): 300-320.

Gorman, C.H. 1977. A priori models and Thai prehistory: a reconsideration of the beginnings of agriculture in Southeastern Asia. In C.A. Reed (ed.), *The Origins of Agriculture*. pp.321-356. The Hague: Mouton.

Higham, C. 1989. *The Archaeology of Mainland Southeast Asia*. Cambridge: Cambridge University Press.

Higham, C. 1995. The transition to rice cultivation in Southeast Asia. In T.D. Price and A.B. Gebauer (eds.), *Last Hunters First Farmers: New Perspectives on the Prehistoric Transition to Agriculture.* pp. 127-155. Santa Fe: School of American Research Press.

Higham, C. 2002. *Early Cultures of Mainland Southeast Asia*. Bangkok: River Books.

Institute of Archeology. 2001. Vietnamese archaeology: some essential scientific achievements. In Institute of Archaeology (ed.), *International Conference on One Century of Vietnam Archeology: Achievement, Orientation and Prospect*. Mimeograph. Hanoi: Institute of Archeology, National Centre for Science and Humanities. (In Vietnamese with English abstract).

Kennedy, W.J. and J.D. Taylor. 1968. Aragonite in rudists. *Proceeding of the Geological Society of London*, pp. 325 - 331.

Martini, R., et al. 1998. Occurrence of Triassic foraminifers in carbonate deposits from the Ninh Binh area (North Vietnam). *Comptes Rendus de l'Académie des Sciences*, Paris 326: 113 - 119.

Moser, J. 2001. *Hoabinhian: Geographie und Chronologie eines steinzeitlichen Technokomplexes in Sũdostasien*. Koln: Linden Soft.

Nguyen Quang Mien and Pham Ly Huong. 2001. 14C-Dating in study of archaeology in Vietnam. In Institute of Archaeology (ed.), *International Conference on One Century of Vietnam Archeology: Achievement, Orientation and Prospect*. Mimeograph. Hanoi: Institute of Archeology, National Centre for Science and Humanities. (In Vietnamese with English abstract).

Solheim, W.G. 1972. An earlier agricultural revolution. *Scientific American* 226: 34-41.

Vo Van Tuyen. 2001. The contribution of studying archaeological stone in Nghe An and Hatinh provinces. In Institute of Archaeology (ed.), *International Conference on One Century of Vietnam Archeology: Achievement, Orientation and Prospect*. Mimeograph. Hanoi: Institute of Archeology, National Centre for Science and Humanities. (In Vietnamese with English abstract).

Yi, S. *et al.* 2004. AMS dating from archaeological sites in Vietnam. *Khao Co Hoc* 128(2): 86-90. (In Vietnamese with English summary).

Yi, S., J. Lee, and S. Kim. 2005. On the Hoabinhian: a chronometric study of the Hang Cho site. *Hankuk Sanggosa Hakbo* (Journal of Korean Ancient Historical Society) 49: 27-57. (In Korean).

Yi, S. *et al.* 2005. On the Hoabinhian lithic industry. *Hanguk Kogo-Hakbo* (Journal of the Korean Archaeological Society) 57: 5-34. (In Korean).

Yi, S. *et al.* in press. *Excavation at Hang Cho cave, Vietnam*. Seoul: Institute of History, Seoul National University. (In Korean).