

Hoa Binh Culture in Vietnam after Nearly A Century since Its Discovery

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Abstract: This paper presents an overview of the Hoa Binh culture in Vietnam after nearly a century since its discovery. It covers topics ranging from historiography, new insight into habitats, and characteristics of archaeological tools, to economic activity, the rise of populations and relationships between the culture and the archaeological sites inside and outside Vietnam. Vietnamese archaeologists consider the Hoa Binh culture to be a phenomenon of a material culture created by a specific group of people, of possibly one ethnicity, who inhabited the mountainous limestone terrain of northern Vietnam. The culture dating c. 20,000 to 7,000 BP consist of three periods: (i) the pre-Hoabinhian (20,000-11,000 BP), (ii) the typical Hoabinhian (11,000-9,000 BP), and (iii) the developing Hoabinhian (9,000-7,000 BP) [1, p.126], [35, pp.3-8], [30, pp.22-30]. The author finds that Hoabinhian was a Southeast Asian phenomenon which originated in northern Vietnam. It represented the transition periods from Pleistocene to Holocene, from Palaeolithic to Neolithic, and from a hunter-gather society to primitive agricultural activities. The Hoa Binh culture has left a legacy of outstanding cultural values relating to many topics such as man's adaptation to the environment, settlement patterns, food exploitation strategy, and tool making techniques.

Keywords: Hoabinhian, Neolithic, pebble tool, technocomplex, Southeast Asia.

Subject classification: Archaeology

1. Introduction

The first Congress of Prehistorians of the Far East, held in Hanoi in January 1932, adopted a resolution which defined the Hoa Binh culture as first described by French archaeologist M. Colani. The resolution, however, excluded the Palaeolithic period of

this culture [45, pp.11-12]. The concept of the Hoa Binh culture was developed according to M. Colani's research on, and expeditions to, the caves in Hoa Binh Province and neighbouring provinces in northern Vietnam from 1926 to 1930. The concept of "Hoabinhian" was initially based primarily on stone tool assemblages that

had several features in common, including rough-hewn tools created using a unifacial flaking technique. Short axes, disk-shaped tools, almond-shaped tools, bone tools, hammerstones, and percussion stones are common items found in the collection. They were discovered in layers of sediment inside caves containing mollusc shells, and sometimes ochre and pottery fragments, as well as human and animal remains. M. Colani divided the Hoabinhian into three sub-stages: Hoabinhian I (Palaeolithic), Hoabinhian II (Mesolithic), and Hoabinhian III (Neolithic or Bacsonian) [42], [43, pp.299-422].

After nearly a century since the first discovery (from 1926 to 2020), at least 145 Hoabinhian sites have so far been unearthed in Vietnam. And, Hoabinhian-like remains have also been found in a number of other countries in the Asia-Pacific region including southern China, Japan, and Australia. Important defining characteristics, acceptable date ranges and comparisons of assemblages recovered from Vietnamese Hoabinhian sites with those found in other countries have been studied and their findings discussed. This paper summarises several fundamental issues relevant to today's understanding of the Hoa Binh culture in Vietnam, and places the latest information in a wider context in order to highlight outstanding issues which need further study.

2. Historical research

2.1. In the early 1960s, Vietnamese archaeologists began conducting studies into the Hoa Binh culture's material remains,

thanks to the assistance of their Soviet counterparts. As a result, a research programme entitled "*Первобытное прошлое Вьетнама*" (Vietnam's Primitive Past) shed light on several Hoabinhian issues. The Hoa Binh culture was first defined as an archaeological culture, belonging to the Mesolithic period. It was evident inside limestone caves in Hoa Binh Province and neighbouring provinces in the form of stratigraphic layers containing freshwater mollusc shells. Hoabinhian tools were fashioned from pebbles, which included eight basic types: unifacially flaked axes, bifacial hand axes, oval hand axes, long axes, short axes, oval or discoidal scrapers, end scrapers, and Bacsonian axes. Also, percussion stones, hammerstones, grinding tables (netherstones), bone tools, horns, and pearl shells have been recovered [46, pp.85-90].

In the 1960s and 1970s, some Hoabinhian-like remains were discovered in Southeast Asia and Southern China [24]. At that time, the Hoa Binh culture was considered to be only a Southeast Asian phenomenon. The Hoabinhian extended not only in space and time but also in its conceptualisation. It was regarded as the Hoabinhian "tradition", the Hoabinhian "complex", or even the Hoabinhian "technocomplex" across Southeast Asia, existing from the Late Pleistocene to the Holocene c. 50,000 to 5,000 BP [28, pp.145-162], [29, pp.34-41], [18].

During a conference held in Hanoi in 1992, Southeast Asian archaeologists discussed the conceptualisation at that time, and acceptable date ranges of the Hoa Binh culture. However, they failed to agree on certain aspects, such as terminology. For example, should this prehistoric period be referred to as the Hoa

Binh culture or cultures, the Hoabinhian tradition, the Hoabinhian complex, or the Hoabinhian technocomplex? They did, however, unanimously agree to adopt the term “Hoabinhian concept”, which had previously been introduced by M. Colani. They also agreed that the Hoabinhian began during the Late Pleistocene and ended during the Early Holocene [35, pp.3-8].

2.2. To date, 145 Hoabinhian sites have been discovered in Vietnam. A number of aspects have been studied and the findings summarised in the 1989 publication “The Hoa Binh Culture in Vietnam” [1] which refers to characteristics of recovered artefacts, defining and dating the Hoa Binh culture and the lives of the people who made the implements. In the Abstract and Introduction, the author touches on the different sub-periods of the Hoa Binh culture and how Vietnamese archaeologists believe it originated.

The Hoabinhian populations inhabited caves and rock shelters, and they used a combination of tools, such as oval axes, disk-shaped scrapers, short axes, sumatraliths, and edge-ground polished stone axes made with hammerstones, percussion stones, and grinding stones. Numerous flakes, perforated pebbles, pebbles bearing circular depressions, as well as a small number of bone tools and mollusc shells have also been recovered from several sites. The Hoabinhian people were mainly hunter-gathers; typically, they would have caught freshwater molluscs, and hunted small to medium-sized animals. There is currently no strong evidence to suggest they carried out agricultural activity, whether domestication or cultivation.

Archaeological artefacts dating back to c. 7,000 BP in Vietnam are collectively

regarded as arising from the post-Hoabinhian Neolithic period rather than belonging to the Hoa Binh culture. Stone tool industries in other countries which primarily used pebble tools equivalent to those defined as Hoabinhian are collectively referred to as “Hoabinhian-like”, i.e. related to Hoabinhian.

3. New research findings on the Hoa Binh culture

3.1. The inhabitation area

Out of the 145 Hoabinhian archaeological sites, only two are open-air. These are the Sap Viet site, located on the ancient shelf of the Da River in Son La Province [14, pp.22-32], and the Mau A site, located on the ancient shelf of the Red River, Yen Bai Province. The latter site dates from c. 12,829 to 13,180 BP [6, pp.12-18]. The remaining known sites are all caves or rock shelters found within limestone mountains in various north-western and north central provinces of Vietnam.

These digs are primarily located in a number of karst sub areas and seem to share similarities between groups of sites based on local cultures. However, local groups exhibit differences in terms of the scale of site distribution, the density of artefacts, and the outstanding ratios of some tool types among the more commonly-known tool shapes which are typical of all Hoabinhian assemblages [7, pp.1-13].

Among these areas, Hoa Binh and Thanh Hoa Provinces are home to the largest number of sites totalling 106, which are grouped into clusters along a number of contiguous valleys with five to ten sites

forming a cluster. The sites are composed of thick cultural layers, dating back to relatively early periods in time. Compared to neighbouring sites, the ones mentioned below are artefact-rich. For example, a group of sites in the suburban district of Luong Son, Hoa Binh Province consists of eight caves. Among them is Cho Cave, with a 3m cultural layer, dating from 22,000 BP, containing a considerable number of artefacts. The existence of early Hoabinhian relics, such as those retrieved from Cho Cave, indicates that such locations are considered to have been initial dwelling places and neighbouring caves became inhabited as populations expanded. This reflects the residential mobility pattern of the Hoabinhian people according to geographical areas and lineage.

Most Hoabinhians lived mainly inland. Only two groups inhabited coastal regions: the Soi Nhu in Quang Ninh Province, and the Trang An in Ninh Binh Province. Except for several unique features, these two groups were fundamentally representative of the Hoa Binh culture. The Trang An population inhabited 15 cave sites dating from approximately $27,750 \pm 100$ to $4,000 \pm 60$ BP located on the south-western edge of the Red River Delta. The terrain was only 2m to 3m higher than the present day sea levels. In approximately $9,500 \pm 30$ BP, the Flandrian Transgression entered the Trang An lowlands and over a period of 6,000 years, the water level rose to a maximum of 5.5m, turning the entire Trang An terrain into an island. The remains of this transgression are still visible today as waterlines running along Trang An's limestone cliffs. In this marine environment, the people fished for seafood and also

hunted animals inland. Local residents opted to use limestone tools, dolomite with a high degree of hardness, and Corded Ware pottery. Pottery remains were recovered from three sites: Moi Cave, Vang rock shelter, and Oc rock shelter dating from $7,381 \pm 60$ BC, $8,720 \pm 235$ BP, and $8,410 \pm 295$ BP respectively. These are currently considered to be the earliest known items of pottery found in Vietnam and Southeast Asia [32, pp.53-65], [33, pp.64-73]. Findings from these Vietnamese coastal sites suggest that the Hoa Binh culture had different characteristics to those of the Malay Peninsula, where people piled up innumerable amounts of clam shells on the high dunes along the coast.

3.2. The environmental fluctuations

The climate of the Holocene epoch in Southeast Asia is considered to have been a neothermal one - temperatures and weather conditions at that time were comparable to today's environment. It has therefore been suggested that Holocene populations culturally adapted to their environment in a similar way as today's rural communities. However, recent studies have shown that such reasoning is too simplistic.

Thanks to their magnetic responsiveness, several Hoabinhian caves in northern Vietnam have yielded evidence to suggest that the period from the Late Pleistocene to the Holocene experienced a number of temperature variations between hot, cold, and cool phases. The period of around 12,900 to 11,400 BP included the Younger Dryas which affected the climate of Eastern Europe. Meanwhile, the period from 11,400 to 8,800 BP saw a tenfold increase in the

formation rate of sediment deposition in Hoabinhian caves compared to the previous period when there had been a substantial increase in rainfall in northern Vietnam [5, pp.410-417].

In addition to heavy rain, humidity increased, and the tropical rainforests expanded. Rivers and lakes became full with mountain snails (*Cyclophorus* sp.), stream snails (*Antimelania costula*), and species of bivalve molluscs. Hoabinhian populations made use of these food sources, discarding the shells which later formed 3m to 5m thick layers of strata. Such shell deposits have been recovered from a number of caves such as: Xom Trai Cave, Lang Vanh Cave, and Cho Cave in Hoa Binh Province, as well as Con Moong Cave and Dieu rock shelter in Thanh Hoa Province. Cold weather and heavy rain were some of the reasons why the majority of Hoabinhian residents lived inside caves at that time [33, pp.64-73].

Publications pertaining to pollen and spores recovered from boreholes in the Red River Delta also reveal that the area had experienced a number of alternating climatic cycles during the Holocene period. From c. 9,950 to 9,310 BP the environment was hot and humid; between c. 9,310 and 8,850 BP the climate was cold and dry; between c. 8,640 and 6,340 BP it was hot and dry; between c. 6,340 and 4,530 BP the weather was hot and humid again; between c. 4,530 and 3,340 BP it was cold and damp; between c. 3,340 and 2,100 BP it was hot and dry; between c. 2,100 and 1,720 BP cold and humid, and between 1,720 BP up to the present day, there have again been hot and humid periods [22, pp.4-28].

Some other studies also indicate that between c. 30,000 and 20,000 BP, Vietnam's

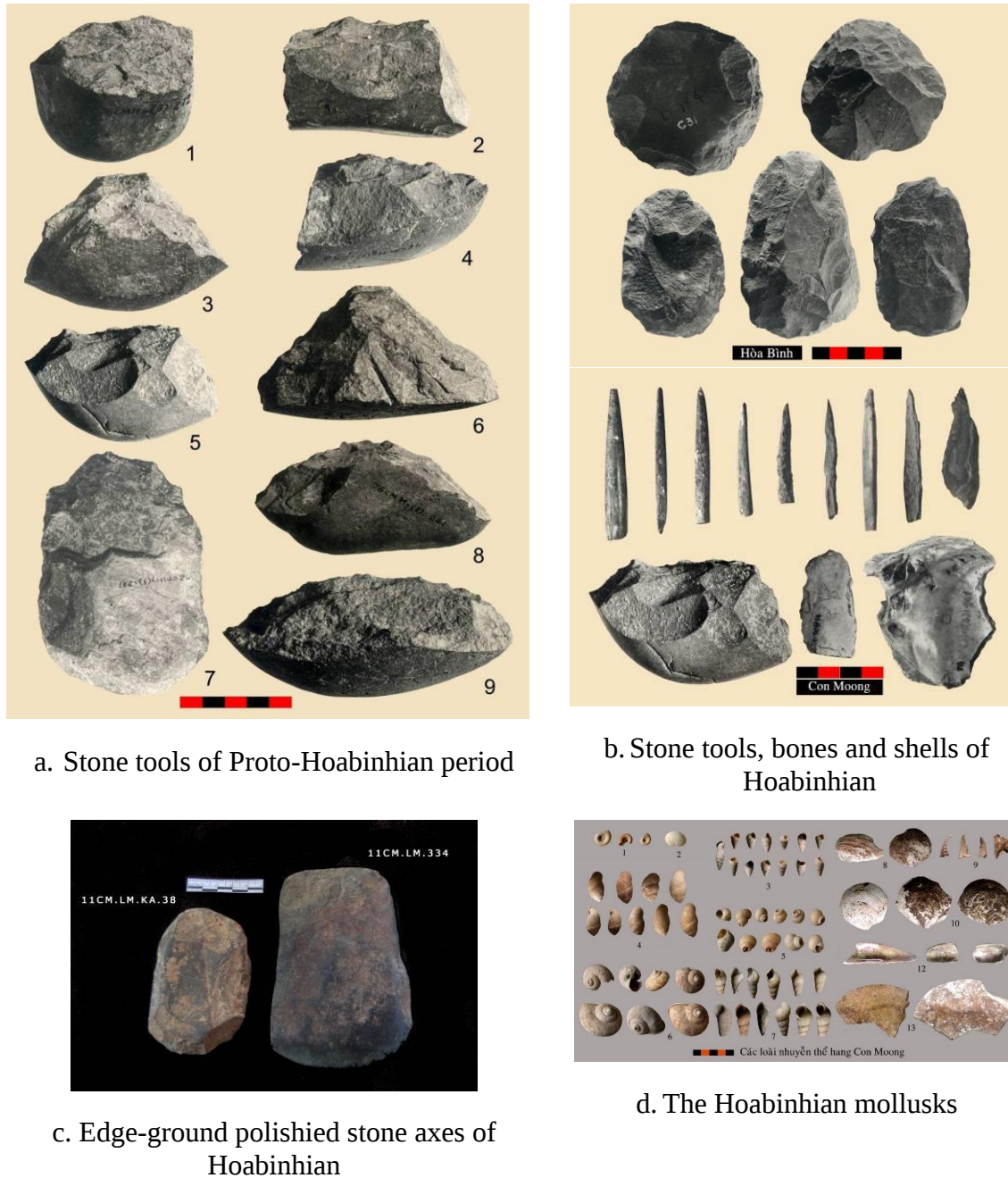
climate was on the whole temperate and cool, alternating between dry and cold periods. Between c. 20,000 and 12,000 BP, temperatures rose again, but humidity remained low. Since c. 12,000 BP, the climate has become hot and humid again [34, pp.81-86]. After c. 7,000 BP, the Middle Holocene marine transgression reached a peak of 5.5m, causing temperatures to rise and rainfall to decrease. After c. 5,000 BP, the sea level gradually receded, and people began to exploit the coastal plains and build prehistoric marine cultures characteristic of the Middle Neolithic period [32, pp.36-49]. In such an environment, people gradually occupied the coastal plains, creating unique cultural characteristics in each period, from the Early to Middle to Late Neolithic periods, as well as from the pre-Dongsonian to Dongsonian periods in northern Vietnam [4, pp.3-18].

3.3. The Hoa Binh industry

The unifacial flaking technique used to create pebble tools is typical of Hoabinhian populations. This technique was renowned for using the natural smooth pebble surface, and creating a sharp edge on one side only. The technique was used to make choppers, short axes and sumatraliths. Hoabinhian populations also perfected a bifacial flaking technique. This was common with tools such as almond-shaped axes, oval axes, and sometimes short axes and sumatraliths. However, this bifacial flaking technique was virtually absent in post-Neolithic assemblages in Vietnam and Southeast Asia. Overall, the most typical type of tools recovered from Hoabinhian sites are still: sumatraliths, short axes of various sub-

types, and several categories of pebble tools such as choppers, scrapers, tools made from broken pebbles, and flake tools; the latter were rarely retouched.

Figure 1: Stone Tools



Source: Hoang Xuan Chinh (Ed.) (1989), *The Hoa Binh Culture in Viet Nam*, Institute of Archaeology, Hanoi.

Previously, edge-ground polished stone axes were thought to have appeared relatively later on. In fact, axes recovered from Hoabinhian sites date back to the somewhat earlier date of c. 20,000 BP. However, the number of such tools was small, and they were made of raw pebbles with inconsistent shapes. This contrasts with the edge-ground polished stone axes recovered from Bacsonian sites. Here, the majority of such axes were made of thick, nearly cylindrical-shaped pebbles with oval-shaped cross-sections, blade edges displaying grinding marks, and most of their natural pebble surfaces removed (Figure 1).

3.4. *The Hoabinhian economy*

Direct evidence of agricultural activity and animal husbandry during the Hoabinhian period is relatively unclear. Several types of nuts recovered from Spirit Cave, the Banyan Valley Cave, and the Tham Pha Chan Cave in northern Thailand suggest that Hoabinhian residents first carried out plant domestication in Southeast Asia [18, pp.300-320], [40, pp.567-599]. A number of pig bones recovered from sites within the Papua New Guinea Highlands, dating back to c. 10,000 BP, are also seen as evidence of early animal domestication in the region [17].

These above mentioned findings denote a single phenomenon, and cannot be representative of Hoabinhian farming and animal husbandry activities in c. 10,000 BP. Several individuals have put forward the hypothesis that Hoabinhian populations may have known how to cultivate tuber rather than seed crops similar to horticulture;

however, there is no archaeological proof. Reviewing the artefacts excavated from Hoabinhian sites in Vietnam suggests that economic activities in this period involved hunting and gathering practices. Hunting mainly centred on small to medium-sized animals. There was high species richness, but the number of individuals of each species was low. Hoabinhian people seasonally collected a variety of molluscs, including mountain snails (*Cyclophorus* sp.) and stream snails (*Antimelania costula*). The coastal inhabitants caught molluscs at sea, and grew plants and hunted animals on the mainland [31, pp.24-37]. Hoabinhian people exploited a diverse range of species. In other words, they did not over-exploit or threaten any one species in order to avoid the latter's extinction and thereby a balanced and sustainable ecological environment was maintained.

3.5. *Hoabinhian origins*

Most archaeologists consider Vietnam to be the birthplace of the Hoabinhian culture since the country is home to many ancient archaeological sites and artefacts typical of this period. Before the Hoabinhian era in Vietnam, there were two known stone tool industries from the Late Pleistocene: the Nguom industry (c. 40,000 to 23,000 BP) and the Son Vi culture (c. 30,000 to 11,000 BP). The Nguom industry focused on flake tool production using techniques different to those of the Hoabinhian period. Only the Son Vi culture is considered to have descended from the Hoabinhian [12,

pp.178-179]. During this transition, there was a parallel period of co-existence between the two populations from c. 20,000 to 11,000 BP [7, pp.13-17]. Recent excavation work of Con Moong Cave yielded a number of artefacts found at depths of around 3.6m to 10.14m characteristic of both the pre-Sonvian and pre-Hoabinhian periods. They included not only small pebble tools but also quartzite flaked tools and limestone tools found at depths of 3.6 and 5.1m, dating c. 26,000 $\pm$ 1,300 BC and 36,000 $\pm$ 1,900 BC respectively. And further down below 5.1m extending to 6.8m, quartz flake tools were recovered dating back to c. 42,000 $\pm$ 2,600 BC and 55,800 $\pm$ 4,800 BC. Such flake tool artefacts were also present in deeper layers from 6.8m to 10.14m and dating back to c. 63,000 $\pm$ 7,300 BC and 73,900 $\pm$ 9,900 BC (Figure 2) [25, pp.1-26]. Therefore, the question who introduced Late Pleistocene pebble technology to Vietnam is still being studied in a wider context.

From the perspective of historical linguistics, there is evidence that three language families existed during the Late Pleistocene and Early Holocene periods in Southeast Asia: Austroasiatic, Austronesian, and Tai-Kadai languages. These belonged to the widespread and commonly spoken Austric language family, which arguably could have been the language of Hoabinhian populations scattered across Southeast Asia [11, pp.1-6].

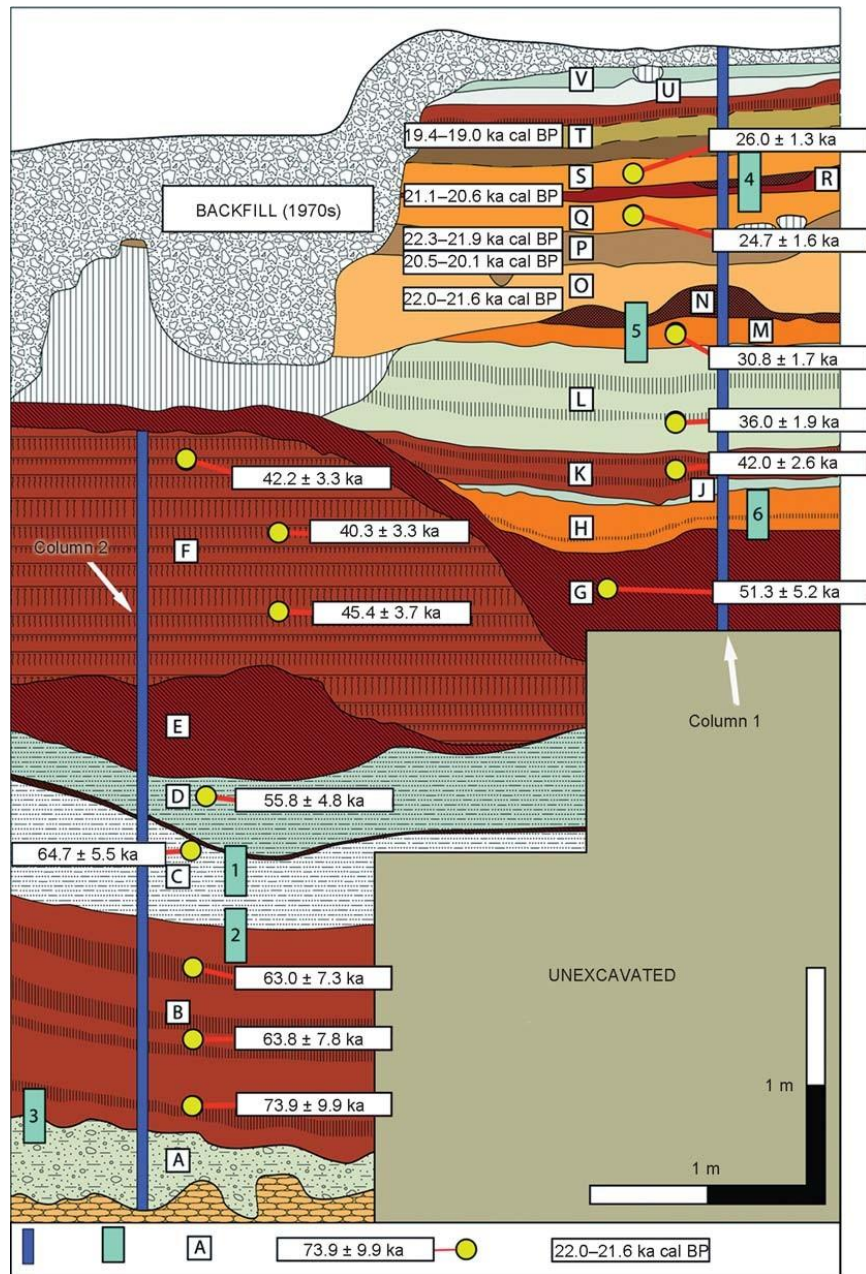
Southeast Asia's common language structure on the mainland and islands broke up in c. 5,000 BP. Austronesian-speaking

people lived in the coastal areas of Southeast China, Northeast Vietnam, Taiwan, the Philippines, and the islands of Oceania. Adzes and quadrilateral axes have frequently been recovered from these areas. The Indochinese Peninsula, where the Austroasiatic language family was thought to have arisen, was coincidentally the main distribution area of shouldered axes [11, p.5].

Peter Bellwood was the first to suggest that the Malayo-Polynesian speaking populations who made their homes on islands, and the mainland Mon-Khmer speaking people made contact with each other in c. 4,000 BP, based on evidence from ceramic artefacts recovered from the An Son (Long An Province) and Man Bac (Ninh Binh Province) archaeological sites [16, pp.5-9]. From a bioanthropological perspective, human remains have been found in at least 38 Hoabinhian sites in Vietnam, most of which belonged to people with complex cranial and dental morphologies [3, pp.5-12].

Having researched the morphology of Hoabinhian crania using metric and non-metric methods, some bioanthropologists have postulated that Neolithic populations in Southeast Asia were Hoabinhian descendants. Similarities between skull dimensions of these Hoabinhian people and modern Melanesian, Australian and Andaman Island residents suggest that the Hoabinhian descendants initially inhabited Southeast Asia and shared a common ancestor with today's Melanesian and Aboriginal Australian populations [21, pp.117-132].

Figure 2: Stratigraphy of Deposits with Chronological Definitions in Con Moong Cave, Based on Results of Archaeological Work Conducted in 2010-2014



Notes: a – bulk sample column; b – micromorphology sample; c – lithostratigraphic unit; d – OSL age and sample position; e – ¹⁴C age (charcoal and shell)

Source: McAdams C., Morley M.W., Fu X., et al. (2019), “The Pleistocene Geoarchaeology and Geochronology of Con Moong Cave, North Vietnam: Site Formation Processes and Hominin Activity in the Humid Tropics”, *Geoarchaeology*, Vol. 35, Issue 1.

4. The Hoa Binh culture in relationships

4.1. With the Bac Son culture (*Bacsonian period*) in Vietnam

The Bacsonian people existed during the Early Neolithic period at the same time as the late Hoabinhian population in northern Vietnam. The first Bacsonian artefacts were discovered by H. Mansuy and M. Colani from 1924 to 1926. Discovery of these artefacts indicated the existence of the Bac Son archaeological culture which appeared mainly within Bac Son limestone cave sites in Lang Son Province, northern Vietnam. The fundamental distinguishing feature of this archaeological culture was the popularity of edge-ground polished stone axes (Bacsonian axes) and stones marked with two parallel grooves (Bacsonian marks) shaped into small elongated pebbles [44]. At the time this paper was published, nearly 60 Bacsonian sites have been found, dating from c. 11,000 BP from 7,000 BP. In addition to the two above mentioned stone tool types, a number of other artefacts were recovered including: percussion stones, hammerstones, grinding stones, quadrilateral axes, pebbles with circular depressions similar to Hoabinhian examples, and small retouched flaking tools from the Nguom industry.

The Bac Son culture is evident in archaeological sites in an area smaller and more contained than its Hoabinhian counterpart. While the Bac Son culture is believed to have developed after the Hoa Binh industry, they both ended in c. 7,000 BP and both produced pebble tools. However, the shapes of the Bacsonian tools were less well defined and this culture

produced far more homogeneous edge-ground polished stone axes, “Bacsonian axe” and “Bacsonian marks” (two parallel grooves on small elongated pebble artefacts with unknown usage).

As Bacsonian sites are located next to areas that were once home to communities which used flake tools, some of these digs also yielded unifacial retouched flaking tools made with the Nguom industry stone-making technique. The main economic activity of both the Hoabinhian and Bacsonian populations was based on hunting and gathering and there is no direct evidence of farming and husbandry practice. It is supposed that the Hoabinhian and Bacsonian periods existed at the same time but as two independent cultures, from c. 11,000 to 7,000 BP, and hence they would have had some items in common. Also, it could be said that they jointly represented the Early Neolithic period in Vietnam under the term: Hoabinhian-Bacsonian.

Following the Hoabinhian period from c. 7,000 BP, Vietnam saw several Middle Neolithic cultures flourish and trade with one another as separate populations. These included: the Cai Beo, which inhabited the Red River Delta coastal areas (now Quang Ninh Province and Hai Phong City), the Da But (Ninh Binh and Thanh Hoa Provinces), and the Quynh Van (Nghe An and Ha Tinh Provinces). Populations in the mountainous Central Highlands included: the Eo Bong (Phu Yen Province), the Lang Ga (Gia Lai Province), the Buon Kieu (Dak Lak Province), and the Thon Tam, who inhabited the Krong No volcanic cave system (Dak Nong Province).

During this period, a whole tool flaking technique was developed and shared

between populations; pottery production centres arose and there is evidence that some areas began adopting farming practices and animal husbandry. However, traditions of Hoabinhian-style manufacture of tools such as short axes, oval axes, and dish-shaped scrapers also continued; as did the practice of funerary customs evident by discoveries of corpses fully-bound or tied into a knee-flexed position, buried in residential areas. In general, Hoabinhian items remain part of assemblages from the Middle Neolithic period in Vietnam.

4.2. With some contemporary industries in Southeast Asia

Hoabinhian artefacts have increasingly been unearthed throughout Southeast Asian countries, such as Laos, Cambodia, Thailand, Myanmar, and Malaysia.

In 2004, American archaeologist Joyce White discovered a total of ten cave sites in Laos which yielded Hoabinhian artefacts. These locations include: Tham Mae Lana, Phou Phaa Khao rock shelter, and Tham Vang Ta Leow Cave. The assemblages consisted of pebble tools that had been made using the characteristic Hoabinhian technique [23, pp.25-27].

An iron-shaped implement similar to the type found in the Dieu rock shelter in Vietnam and Sai-Yok in Thailand was recovered from the Tham Mae Lana karst cave in Thailand. In Laos, the remains of a *Homo sapiens* individual dated c. 56,000 to 45,000 $\pm$ 200 BP were discovered deep within the Ngeubhinh Mouxeu rock shelter, together with flake tools made of chert. The upper layers contained typical Hoabinhian tools, such as sumatraliths and oval-shaped

axes [41, pp.5529-537]. Most of the Hoabinhian sites in Laos date from the later Hoabinhian period, such as Tham Vang Ta Leow Cave (Luang Prabang Province) dating c. 9,770 $\pm$ 50 BP [37, p.319]. Therefore, the limestone mountains of central and upper Laos were eventually incorporated into the Hoabinhian cultural sphere.

Some Hoabinhian sites have been identified in Thailand, such as: Sai-Yok Cave, Ongbah Cave, Spirit Cave, Banyan Valley, Tham Pa Chang, Ment Cave, Peteh Kuha Cave, Heap Cave, Khao Talu, Moh Khiew Cave, Lang Kamnan Cave, and Tham Lod rock shelter. Only the Sai-Yok site exhibits three artefact-bearing strata. Here, the deepest layer, more than 4m deep, contains pebble tools, such as side choppers, end choppers, and picks similar to those from the Late Soanian period found in western Punjab and northern India. The middle layer belongs to the typical Hoabinhian industry, while the upper layer dates from the Late Neolithic period [19].

According to some researchers in Thailand, all unifacial flaking techniques evident on artefacts recovered from Thai sites are characteristic of the Hoabinhian industry, but are, however, much older than Hoabinhian sites in Vietnam. For example, the Tham Lod rock shelter in north west Thailand, dating from c. 26,580 $\pm$ 250 BP, and Lang Kamnan Cave in the west dating from c. 27,110 BP [27, pp.22-37].

D. Anderson excavated the Lang Rongrien rock shelter in southern Thailand in 1983, 1985 and 1990. The site has four cultural layers with the following periodisation: (i) upper section (from first to fourth levels) from the Late Neolithic period, dated c. 4,000 BP; (ii) the second

layer, 1.5m deep (fifth and sixth levels) yielded Hoabinhian stone tools dating from c. 7,000 BP to 8,600 BP; (iii) the third (seventh level), is 1m thick and contained no artefacts as this stratum consisted of fallen limestone; and (iv) a group of artefacts were recovered from the fourth layer (eighth, ninth and tenth levels), dating from c. 27,000 BP to 37,000 BP, of which 90% consisted of small flaked tools. This suggests that the flaking technique they display existed before the Hoabinhian pebble tool technique arose [15, pp.73-74].

In 1991, Surin Pookajorn discovered and excavated Moh Khiew Cave in northern Krabi Province, southern Thailand, located about four kilometres from Lang Rongrien rock shelter. This cave has many cultural layers. A stratum containing Hoabinhian tools was sandwiched between an upper layer containing edge-ground polished stone axes, and a lower layer with flake tools, similar to those found in Lang Rongrien. However, further excavation below the layer with flake tools revealed stratum containing pebble tools, which S. Pookajorn linked with those found at the Kota Tampan Palaeolithic site in Malaysia [26].

Regarding the relationship between pebble and flaking techniques, Ha Van Tan suggested that the Lang Rongrien (Thailand) and Nguom (Vietnam) rock shelters, and Bailan Cave (China) represent the Late Pleistocene flaking technique of mainland Southeast Asia. There is no evidence of the transition from flaking to pebble tool techniques by populations who inhabited these regions. At the Nguom rock shelter, the ratio of flaking tools dropped while that of flaked pebble tools increased.

However, the latter were not characteristic of those commonly found at the Son Vi and Hoabinhian sites [10, pp.45-48].

In Cambodia, Hoabinhian traces have been found in the Laang Spean Cave in Battambang Province. Out of a collection of 9,500 stone tools, 99.6% were flake tools, while the rest were pebble tools, such as dish-shaped scrapers, short axes, various types of sumatraliths, and Corded Ware pottery from the late Hoabinhian period c. 6,240 $\pm$ 70 BP [41, pp.529-537].

Recently, further excavation work down to the deepest layer at 5m, dating c. 71,000 BP to 26,000 BP, exposed tools that had been produced using the flake tool technique. Above this lowest level, Hoabinhian artefacts from c. 11,000 BP to 5,000 BP were uncovered. Items included choppers, chopping tools, sumatraliths, and oval-shaped tools along with ox, deer, hog, and rhino bones. The top level at a depth of 1.2m contained evidence of Palaeolithic burial practices from c.3,300 BP [20, pp.1-15].

Around 1960, U Aung Thaw found evidence of the Early Neolithic period in Padah-Lin Cave in the Shan Highlands, Myanmar, comparable to the Hoabinhian period in Vietnam [36].

Therefore, Hoabinhian tool production techniques across mainland Southeast Asia have some elements in common, including a culture of communities of people who lived in caves, caught gastropods, and made pebble tools, mostly unifacial flaked ones. These communities were hunter-gathers who occupied vast areas. They gave rise to a united Southeast Asian region which began to culturally and linguistically diversify.

4.3. With Hoabinhian-like sites in southern China

Southern China is home to hundreds of archaeological sites that have yielded stone tool artefacts dating from c. 30,000 to 7,000 BP made using the pebble flaking technique. Some of these sites date back to the Early Neolithic period and exhibit Hoabinhian-like attributes of the Late Palaeolithic period in the region and relate to Hoabinhian populations in northern Vietnam [2, pp.214-222].

Dushizi Cave (独石仔), (Guangdong Province) is 4m deep with five strata. The uppermost layer (the second level), dating back to c. 11,500 BP, bore unifacial flaked pebble tools, axe-like tools, and general flaked tools, while no sumatraliths and short axes were found. The next stratum (the third level) contained pebble percussion tools, pebbles with holes through them, as well as bone tools. The lowest layer (the fourth level) is where pebble percussion flaking tools, flaked tools, as well as remains of *Homo sapiens* and a variety of fauna were found dating from c. 15,350 $\pm$ 250 BP and 16,680 $\pm$ 570 BP [49, pp.65-79]. Thus, the unifacial flaking technique arose from the Late Pleistocene pebble tool production industry.

A typical Early Neolithic site in Guangdong is Huangyan Cave (黄岩洞). The stratigraphy of this site is 2m thick, divided into cultural layers. The below layers contained mainly pebble tools with effects on the cobblestone edge, disc tools, oval axes, and polished stone axes [48, pp.161-163]. This complex of artefacts exhibits the same pebble flaking tradition found in Dushizi Cave.

In Guangxi, the Bailian Cave site (白莲洞) exhibits three consecutive early-to-late cultural periods/stages. The first period (c. 37,000 $\pm$ 2,000 BP) is characterised by small flaking tools with some retouched markings. During the second period (c. 37,000 $\pm$ 2,000 BP), apart from generic flake tools and unifacially flaked tools, pebbles with holes through them and edge-ground polished stone axes were also found. The third period (c. 8,000 $\pm$ 800 BP and 7,080 $\pm$ 125 BP) exposed percussion-flaked pebble tools, pebbles with holes through them, grinding tables (netherstones), and pottery remains [50, pp.161-163]. Thus, the Late Pleistocene flaking technique originated before the unifacial flaking technique found in Bailian Cave.

Zengpiyan Cave site (增皮岩) (Guangxi Province) was excavated in 1973, 1976, and 2001, and was systemically studied in the context of other Early Neolithic sites in southern China. These sites contain evidence of the transition between different periods. The most recent stratum, dated c. 11,310 $\pm$ 180 BP, lies below the Early Neolithic layer that contains edge-ground polished stone axes, oval- and dish-shaped tools fashioned on pebbles, stones with holes through them, generic stone tools, mollusc shells and Corded Ware pottery. This layer also yielded human remains of individuals who had been buried mainly in a sitting position.

In general, Early Neolithic sites in southern China have a high proportion of pebble tools carved from a small portion of the pebble to create a fringe, with most of the natural pebble surface preserved. At the same time, the appearance of oval- and dish-shaped tools and edge-ground polished stone axes were discovered, reminiscent of

common Hoabinhian techniques from northern Vietnamese sites, which contained few sumatraliths and short axes, the typical morphology of Hoabinhian, and Bacsonian axes.

However, some discoveries of tools made using the pebble flaking technique from Late Pleistocene and Early Holocene sites in southern China are worth taking into consideration.

Firstly, the Hoabinhian technocomplex at Xiaodong (硝洞) rock shelter in China's Yunnan Province, said to date from c. 24,400 to 43,500 BP. It can be argued that due to this site Yunnan was “the cradle of the Hoa Binh culture,” from where populations and their associated material culture spread to neighbouring Southeast Asia [39, pp.1-9].

Secondly, the date of Corded Ware pottery production at Xianren (仙人) Cave in China's Jiangxi Province is c. 10,870 ± 240 BP together with choppers, scrapers, dish-shaped tools, stone tools, horns, and mollusc shells [47, pp.243-250].

Thirdly, evidence of phytoliths recovered from Yahuai (娅怀) Cave in China's Guangxi Province, shows that people from that period harvested plants, such as bamboo and palm trees since c. 30,000 BP. They were also able to cultivate wild rice from c. 16,000 BP, which is considered the basis of early rice domestication in Huanan, China [38].

It seems obvious that between c. 30,000 and 7,000 BP, populations in both northern Vietnam and southern China used the pebble percussion flaking technique and then the microliths. Cultural differences between the communities in these two

locations are evident from the Early Holocene period onwards and manifested through different implementations of Hoabinhian techniques. What is even more remarkable is that technological advances are more noticeable the longer an archaeological culture continues to exist and hence the more those people who developed and used the technologies had to adapt to their environments.

From the Early Neolithic period, apart from the unifacial percussion technique as a main shared characteristic, Hoabinhian populations in northern Vietnam invented the double-faced percussion technique for manufacturing oval/almond-shaped and short axes, and sometimes sumatraliths. These tools were highly effective for making bamboo and wooden tools. Meanwhile, the double-faced percussion technique used for pebble tools was less popular in southern China.

Communities in both locations invented the edge-ground technique early on, but in China this method is visible mainly on thin or broken pebbles, while in northern Vietnam it was used for thick pebble oval axes manufactured by the Bacsonian populations.

Pebbles with holes through them appeared early on in southern China, firstly from the Late Pleistocene period, and then such artefacts were found scattered around a few Early Neolithic pebble tool sites. Meanwhile, in Vietnam, such pebbles appeared later during the Hoabinhian period and disappeared during the Middle Neolithic period. However, it was afterwards that they became popular in all archaeological cultures until the Late Neolithic period in the Central Highlands, especially the population sites in Lung Leng (Kon Tum Province), Bien Ho (Gia Lai Province), and

Buon Triet (Dak Lak and Dak Nong Provinces) [9].

5. Conclusion

In Vietnam's prehistoric period, the Hoabinhian culture is considered a transitional one from Pleistocene to Holocene, from Palaeolithic to Neolithic, and from hunter-gatherer practices to the start of agricultural activity. Hoabinhian people mostly lived in Hoa Binh and Thanh Hoa provinces, where early sites have been discovered. These two provinces are still considered to be the original locations of Vietnam's Hoa Binh culture. From here, Hoabinhian populations moved to surrounding ecological areas, establishing Middle Neolithic cultures in northern and north-central seaside delta regions and Central Highlands provinces. They also migrated further afield to other mainland Southeast Asian areas, and in so doing created an early prehistoric Southeast Asia which shared the concept of diversity.

Hoabinhian populations left evidence of their existence at several unique sites, demonstrating their adaptability to the changing and harsh environment at the end of the Ice Age. This can be seen in their settlement patterns, food exploitation strategies, and tool making techniques. Geographical and archaeological evidence from the Hoabinhian period confirms that human activity went hand-in-hand with regional environmental changes. It contributed to the interpretation of structural changes in the past, how the local landscape changed, and the effects of human activity on floral and faunal populations.

The diversity of mainland Hoabinhian people, who inhabited caves and rock shelters, and their traditions and cultural achievements, were linked to the tropical monsoon climate and rapid changes in sea level with which they had to contend. They are a society which deserves to be recognised as a leading example of mankind's adaptability, occupying a unique place in the prehistory of Vietnam and Southeast Asia. To gain a deeper and more complex understanding of what makes the Hoabinhian and related Palaeolithic-Early Neolithic periods unique in Southeast Asia and the rest of the world, experts in prehistoric archaeology in Southeast Asia and southern China should collaborate on a joint excavation programme, investigate additional cave and rock shelter sites, and hold more international scientific seminars in order to formalise and share new findings.

Note

¹ Language editor: Stella Ciorra.

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