Tracking the Early Human Migration into Island Southeast Asia[1]

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Introduction

The peopling of Island Southeast Asia has been an interesting point in human history. When and how these early modern humans moved from Mainland Southeast Asia or Sundaland into the Island world make up a major archaeological problem. With the scanty archaeological record during the Late Pleistocene to early Holocene periods, reconstruction can only be made with few archaeological materials recovered. The most durable among these cultural remains are the different stone tools made, utilized, and discarded by these early modern humans across various landscapes. Stone tool technology might be able to provide us with a

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window in reconstructing early human movement into Island Southeast Asia.

This paper presents selected archaeological sites in Mainland and Island Southeast Asia during the Late Pleistocene to Early Holocene period (Figure 1). The focus of the discussion on the different sites surveyed is aimed at looking at different stone tool technologies across time and space.

Mainland Southeast Asia Including Peninsular Malaysia

Vietnam

Vietnam has a number of sites that extend back into the Pleistocene period. As Reynolds (1993:8) stated, "this country already possesses the richest Upper Pleistocene archaeology in South-East Asia and such richness itself will create a more detailed picture of variability when compared to elsewhere." Vietnam has a number of lithic industries

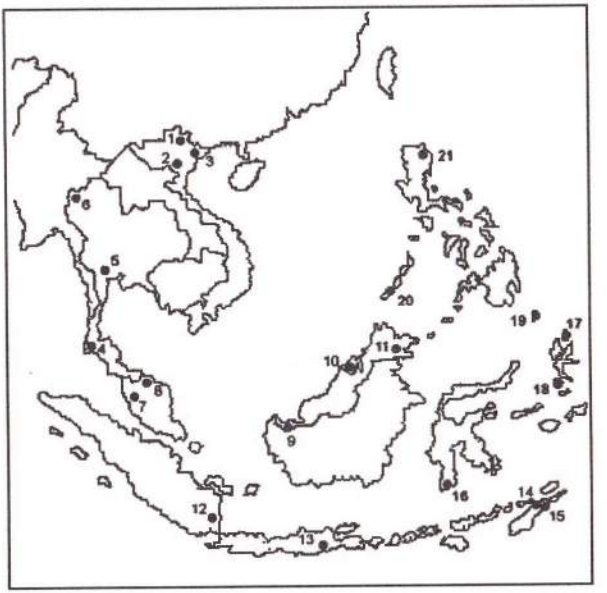


Figure 1. Sites mentioned in the paper: 1. Nguom, 2. Son Vi, 3. Xom Trai, 4. Lang Rongrien, 5, Lang Kamnan, 6. Spirit , 7. Kota Tampan, 8. Ulu Kelantan sites, 9. Gua Sireh, 10. Niah, 11. Tingkayu, 12. Pondok Silabe, 13. Song Keplek, 14. Uai Bobo 2, 15. Lena Hara, 16. Leang Burung 2, 17. Tanjung Pinang and Daeo 2, 18. Golo, 19. Leang Sarru, 20. Tabon, 21. Callaõ

that some archaeologists view in a chronological sequence (Ha Van Tan 1997). These are the Nguomian, Sonvian, Hoabinhian, and Bacsonian.

Nguomian Industry

The Nguom rockshelter in Bac Thai province, Northern Vietnam is the site type for the Nguomian flake industry. The lower strata of Nguom contain primarily flakes made from quartzite and rhyolite materials and a few pebble core tools. Most of the flakes are amorphous in shape and some have retouching on their edges. This industry at Nguom is dated to c. 27,000 BP (Reynolds 1993:8), and Ha Van Tan (1997:38) argues it is contemporaneous with the flake industry of Lang Rongrien in Thailand and the lowest cultural level of Bailian Cave in Southern China.

Sonvian Industry

Sonvian industry is believed to be the immediate precursor of the Hoabinhian industry and is dated between 23,000 and 13,000 BP. According to Ha Van Tan (1997: 37) the Sonvian is characterized by pebble tools flaked only on the edges with the natural cortex preserved on both faces. The Tham Khuong rockshelter assemblage in Lai Chau Province contains a Sonvian assemblage and is initially dated to 28,130 ± 2000 uncal. BP (Bln-1408) and 33,150 ± 2300 uncal. BP (Bln-1412) on land snails (Reynolds 1993:9). However, Ha Van Tan (1997:37) doubts the accuracy of these dates and prefers the more recent shellfish date of 15,800 ±150 uncal. BP (HCMV-03/93). The Tham Khuong has pebble tools, choppers and picks, and this industry indicates a shift from the focus on flakes at Nguom towards increasing use of pebble tools.

Hoabinhian Industry

Xom Trai cave contained a classic Hoabinhian industry (Figure 2), composed of mostly unifacially flaked pebble tools such as sumatraliths (Figure 3 a), short axes (Figure 3d), and an edge-ground form that became popular during the succeeding Bacsonian industry. At Xom Trai, the radiocarbon dates for the Hoabinhian are between 18,000 and 17,000 BP (Ha Van Tan 1997:35). The Bacsonian (Figure 3f) is believed to be the later phase of the Hoabinhian industry and is dated to ca. 11,000 to 7000 BP. As stated above, it is characterized by the presence of edge-ground axes and cord- or vine-impressed pottery.

Thailand

Lang Rongrien rockshelter

Lang Rongrien rockshelter in Krabi, southwestern Thailand, is a well-stratified site that has yielded a deep time depth of human occupation (Anderson 1990, 1997). Excavated by Douglas Anderson (1990) since 1974, the site has at least three cultural horizons. The oldest assemblage is composed of chert flakes, pebble tools, bone and antler objects. The lithic implements include retouched and utilized flakes, end and side scrapers, and a few choppers and core bifaces. The lithic implements were also associated with a number of hearths. This horizon has been dated on charcoal to between 37,000 ± 1780 uncal. BP (SI-6819) and 27,110 ± 615 uncal. BP (SI-6816) (Anderson 1990:21). With the predominance of flakes rather than pebble tools, it is similar to Nguomian of Vietnam.

The middle cultural unit in Lang Rongrien is a Hoabinhian assemblage dating to 9655 ± 90 uncal. BP or 11,250-10,650 cal BP (SI-6817) and 7765 ± 65 uncal. BP or 8710-8390 cal. BP (SI-6213), both dates on charcoal (Anderson 1990:21). This thick deposit contains stone artefacts, faunal remains, and a variety of both freshwater and marine shell species. The faunal remains are dominated by different species of deer such as sambar (*Cervus unicolor*), barking deer (*Muntiacus muntjak*), hog deer (*Axis Porcinus*), and *Cervus eldi*. There are also pig (*Sus* sp.), cattle (*Bos* sp.), and jungle fowl (*Gallus* sp.). The Hoabinhian lithics include discoid and elongated bifaces, choppers, a short axe made from chert, utilized and unutilized flakes, whetstones and cores. Most of these lithic implements were made from quartzite.

Lang Kamnan Cave

Lang Kamnan Cave is located in Kanchanaburi, western Thailand (Shoocongdej 2000). The site was excavated by Rasmi Shoocongdej of Silpakorn University and contains a long sequence of ephemeral human habitation. The lowest layer is of late Pleistocene date, between 27,110 ± 500 uncal. BP (GX-20072) and 10,030±110 uncal. BP (GX-20066) on land snails (Shoocongdej 2000:22). The materials recovered are lithic implements, animal bones, and shellfish. The pre-Hoabinhian lithic assemblage consists of utilized and waste cores and flake stone, hammers, and grinding stones. Animal bones include flying squirrel, porcupine, bamboo rat, turtle, cervids, and bovids. *Canarium* nutshells were also recovered.

The early Holocene assemblage is the same as that in the previous deposit. This period is dated between 7990 ±100 uncal. BP (GX-20069) and 7740±140 uncal. BP (OAEP 1192), both dates on land snails.

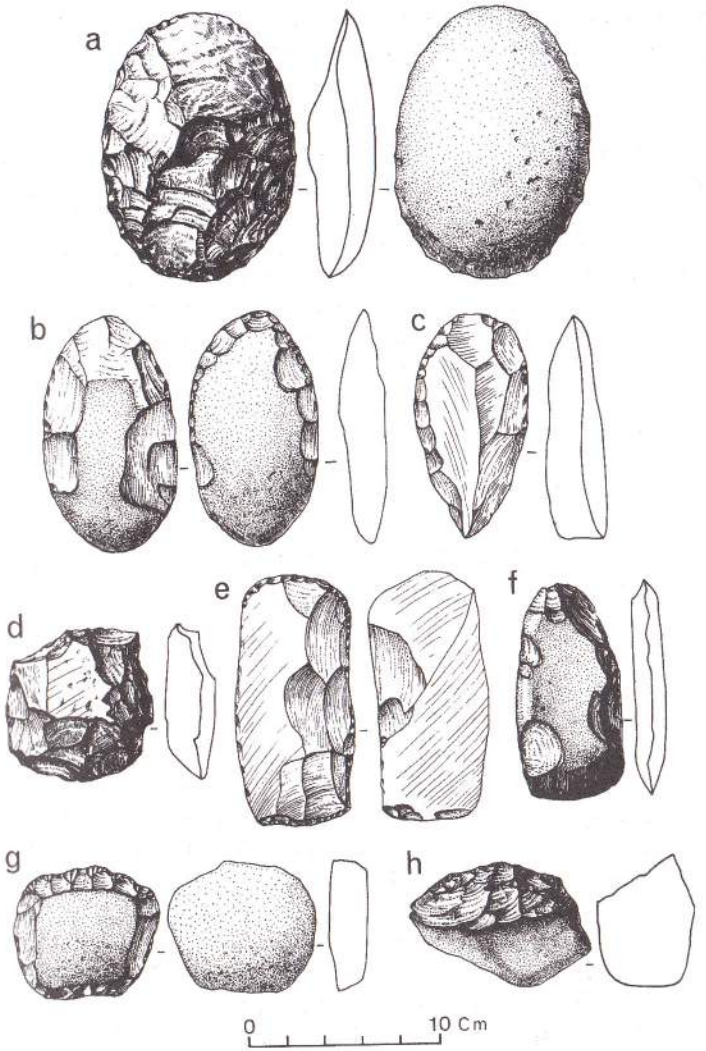


Figure 2. Hoabinhian lithic industry (Bellwood 1979, after P.I. Boriskovsky)

Shoocongdej (2000:28) characterized the Lang Kamnan lithic assemblage as an expedient technology based on the production of "amorphous, unpatterned sizes and shapes of tools." She also stated that Lang Kamnan Cave was used as a temporary campsite during wet seasons, where stone tool making had occurred.

Spirit Cave

Chester Gorman's archaeological work in the uplands of Thailand included excavation of a number of cave sites (Gorman 1971, 1972). One of his main sites is Spirit Cave. Gorman recognized two cultural horizons in Spirit Cave. They both contained stone implements such as unifacial discoids, flakes and grinding stones, but the upper layer also had, in addition, cord-marked pottery, some with resin coating, and stone adzes. Subsistence evidence in the lower cultural horizon included shellfish gathered from the Khong stream below the cave, and also bones of deer, civet, macaque, squirrel, suids, snake, and bamboo rat. Plant remains included seeds of *Canarium*, gourds, almonds, and legumes. Cultural horizon 1 was dated by Gorman (1971) to between 11,690 ± 560 uncal. BP or 15,650-12,350 cal. BP (FSU-315) and 9455±360 uncal. BP or 11,950-9550 cal. BP (GaK 1845). Cultural horizon 2 was dated 8776± 290 uncal. BP or 10,650-9050 cal. BP (FSU- 318) to 8142± 390 uncal. BP or 10,150-8150 cal. BP (FSU 314) (Gorman 1971:303).

Peninsular Malaysia

Kota Tampan

Varying interpretive problems since its discovery by H. Collings in 1938 have beset the Tampan Paleolithic site in Perak, West Malaysia. The site contains stone tools overlaid by volcanic ash and has problems in terms of lithic typology and in understanding the site formation processes (Harrisson 1975). A reexcavation of the site to address these problems was undertaken in 1987 by a team headed by Zuraina Majid (1990). Majid found evidence of a lithic workshop, which included quartzite chunks used as cores, anvils, hammerstones, flakes, and debitage. Flakes and flake tools predominated. A layer of volcanic ash then buried the Kota Tampan workshop that was located near a palaeolake. This ash was initially dated to 31,000 ± 3000 uncal. BP by the fission-track method, and was traced to the eruption of Mount Toba in Sumatra (Reynolds 1993:3). The eruptive history of Mt. Toba has been a subject of investigation by Chesner *et al.*

(1991) and they were able to correlate the Malaysian ash to the Youngest Toba eruption but to a much older date. Using $^{40}Ar/^{39}Ar$ dating, the Younger Toba eruption was dated to 74 ± 2 ka (Chesner *et al.* 1991:202). This makes the Kota Tampan site much older than originally projected.

Gua Gunung Runtuh

Zuraina Majid (1994) also excavated Gua Gunung Runtuh cave in Perak, which contains human remains associated with Hoabinhian industry (Majid 1994, Saidin and Tija 1994). The cave site has a basal date of 13,600 ± 120 uncal. BP (Beta-38338) on a freshwater shell. The "Perak Man" remains are bracketed between dates of 9460 ± 90 uncal. BP (Beta-37818) and 10,120 ± 110 uncal. BP (Beta-38394), also on freshwater shell (Saidin and Tija 1994:16). Perak Man was an adult male in a crouched position, interred in a shell midden. Physical studies reveal an Australo-Melanesian affinity (Majid *et al.* 1994). The lithic implements recovered from the cave include cores, anvils, pebble tools, hammerstones, and large flake tools and debitage (Majid *et al.* 1994:151). Majid *et al.* (1994:166) believe that the cave was also used as a toolmaking site owing to the quantity of lithic debitage. Pebble tools were the main items in the assemblage, made from quartzite. They were further classified as unifacial and bifacial pebble tool, choppers, and perimeter-flaked tools. Faunal remains included monkey, pigs, and reptiles, with abundant riverine shellfish (*Brotia costula/spinosa*).

Ulu Kelantan Sites

Adi Haji Taha has excavated a number of sites in Ulu Kelantan, two of them for his PhD dissertation at ANU. These are Gua Peraling and Gua Chawas (Adi Taha 2000). Gua Peraling is south of the Perias River and has four cultural phases. The lowest cultural deposit contains dense accumulation of cobble flaking debris and implements. Some of the implements are bifacially flaked. Faunal remains include deer, rodents, and freshwater shellfish. This layer is dated to 11,930 ± 100 uncal. BP (ANU 9902) and 11,770 ± 90 (ANU 9903) from freshwater shell (Adi Taha 2000:124 and 136). Adi Taha (2000:124) observed that radiocarbon determination on freshwater shells excavated from two Hoabinhian sites in Kelantan, West Malaysia tended to be much older than charcoal dates from the same layer.

The next cultural deposit is dated to 9730 ± 90 (ANU 9901), also on fresh water shell. A flexed primary burial of a female was excavated in this layer and dated to 9590± 100 uncal. BP (ANU9910) from freshwater shell. The date of this burial is similar to that of the Perak Man mentioned

above. Both burials were dated from freshwater shell and hence problematic in terms of chronology.

The third cultural horizon is dated to 6910± 250 uncal. BP or 8350-7250 cal. BP (ANU 9910) on charcoal (Adi Taha 2000:136). This layer has an extensive ash deposit associated with turtle, large fish, and shellfish. Large edge ground tools were also present.

Gua Chawas has three cultural periods of interest in this period. The lower Hoabinhian layer is dated to 10,770 ± 90 uncal. BP (ANU 9938) on freshwater shell (Adi Taha 2000:134). The succeeding Hoabinhian layer is dated to 4390 ± 90 uncal. BP or 5300-4830 cal. BP (ANU 9462) on charcoal, while the upper layer with pottery is dated to 1874 ± 70 uncal. BP or 1990-1610 cal. BP (ANU 9914), also on charcoal.

Gua Cha in Ulu Kelantan (Adi Taha 1983, 1993) was first excavated by Sieveking in 1954, and in 1979 by Adi Haji Taha and Peter Bellwood. The site contains a thick alluvial deposit with bifacial Hoabinhian pebble tools and human burials. The Hoabinhian layers also contain many animal bones, predominantly pigs (*Sus scrofa* and *Sus barbatus*), with deer, monkeys, gibbons, squirrels, rats, rhinos, and cattle. The middle of the Hoabinhian deposit is dated to 6280 ± 250 uncal. BP or 7750-6550 cal. BP (ANU-2218), on charcoal (Adi Taha 1983:51)

Island Southeast Asia

Malaysian Borneo

Gua Sireh Cave

Gua Sireh is a cave located in the Gunung Nambi limestone massif southeast of Kuching. Harrisson and Solheim first excavated the cave in 1959, then Zuraina Majid in 1977 and Ipoi and Bellwood in 1989 carried out later research. Gua Sireh also has a preceramic assemblage of quartz flakes and shellfish dating to 21,630 ± 80 uncal. BP (ANU 7048) on freshwater shell (Ipoi and Bellwood 1991:391).

Niah Cave

The West Mouth of the Great Cave at Niah in Sarawak was excavated by Tom Harrisson between 1954 and 1968. The cave was used as a habitation and burial site from the Late Pleistocene to mid-Holocene, spanning a period of 40,000 years. A human cranium known as the 'deep skull' was dated by associated charcoal to 40,000 years ago, and identified as morphological grounds by Brothwell (1960) as Australo-Melanesian and resembling Tasmanians. The inner chamber of the West Mouth also contains numerous Neolithic burials.

Though Harrisson and others published a number of reports about Niah Cave, no final report was ever produced and the stratigraphic contexts of the finds have always been contentious. The site was reexcavated by Zuriana Majid (1982) in 1976, and by a large team of specialists headed by Graeme Barker starting in 2000 (Barker 2005, Barker *et al.* 2002,). In reconstructing Harrisson's excavations, particularly the stratigraphic context of the deep skull', Barker's (2002 *et al.*:157) team has produced two new dates for this skull of 42,600 ± 670 uncal. BP (Niah-310) and 41,800 ± 620 uncal. BP (Niah-311) on charcoal, using the ABOX-SC technique. These new dates essentially confirm the previous Upper Pleistocene date obtained by the Harrissons.

A later Pleistocene series of pit features has been dated by Barker (2000 *et al.*:159, 2005) to between 19,650 ± 90 uncal. BP (OxA-11550) and 8630 ± 45 uncal. BP (OxA-11549) on charcoal materials. These pits contain mammal, reptile, bird and fish bones as well as charred plant remains.

The stone artefacts during the pre-Neolithic period are mostly flakes, with a few pebble tools made from coarse-grained stone. Majid (1982:90) described the lithic technology as a process involving the smashing of pebbles and selecting suitable flakes. Bone tools include spatulae and points. There are a few edge-ground tools, estimated to date between 20,000 and 10,000 years ago (Majid 1982).

Niah Cave has an enormous assemblage of biological remains. The identification of the fauna dated to during and after the period of the deep skull includes the now-extinct giant pangolin (*Manis palaeojavanica*), bearded pig, orangutan, macaque, mouse deer, and wild cattle. Pre-Neolithic plants identified from phytoliths, starch grains, and macrobotanical remains include charred parenchymatous tissue of yams, breadfruit, legumes, and tubers of the carrot family (cf. *Apiaceae*) and charred nuts (Barker 2005, Barker *et al.* 2002:159).

Tingkayu

In eastern Sabah, the Tingkayu stone industry yields a Late Pleistocene stone technology, which is quite unique for this region. The site is located close to what was inferred to be a former lake dammed by a lava flow about 28,000 years ago (Bellwood 1988, 1997). The Tingkayu lithic industry includes a fully bifacial lithic technology. Slabs of laminated grey chert were reduced bifacially to produce lanceolate knives and other

forms. Use-wear analysis on these knives suggests a cutting function, but some may also have been used as spear points. This bifacial lithic technology is rare in Southeast Asia. Bellwood (1997:179) proposes "that this tradition was developed locally, perhaps to meet a specific need in this rather unusual lacustrine environment."

Indonesia and East Timor

Pondok Silabe and Song Keplek Caves

Java and Sumatra have been the focus of archaeological research by Truman Simanjuntak, on both Pre-Neolithic and Neolithic assemblages. Two particular cave sites will be cited here: Pondok Silabe Cave in southern Sumatra and Song Keplek in Gunung Sewu in eastern Java (Simanjuntak and Asikin 2004, Simanjuntak and Forestier 2004). Pondok Silabe cave is located in the limestone formation in Baturaja, Sumatra. Simunjuntak and Forestier (2004) identified two cultural deposits, a lower pre-Neolithic and an upper Neolithic. The pre-Neolithic contains flake tools with faunal remains. The fauna includes pig, deer, monkey, orangutan, civet, tortoise, and porcupine.

Song Keplek is located in eastern Gunung Sewu and contains three cultural deposits. The lowest is late Pleistocene, dated to 24,000 to 12,000 BP (Simanjuntak and Asikin 2004). Flake tools were recovered with faunal remains of large mammals such as cervids, bovids and elephants. The pre-Neolithic, or Keplek, period is dated between 12,000 and 4000 BP (Simanjuntak and Asikin 2004:16). A high volume of lithics was recovered, which includes retouched and unretouched flakes. The retouched flakes were classified as scrapers, denticulates, borers, knives, arrowheads and points. Bone tools such as spatulas and points were made from cervid, bovid and *Sus* bones.

Uai Bobo 2 Cave

In East Timor, the Uai Bobo 2 Cave excavated by Ian Glover (1981) contained unretouched flakes associated with rodents, reptiles and shellfish, dated 14,000 to 9000 uncal. BP. At about 5000 BP a different assemblage appeared with the introduction of red-slipped pottery, tanged points, shell adzes, shell fishhooks and shell beads. Pigs, dogs, and later goat were also introduced.

Lena Hara Cave

An archaeological project in East Timor was conducted on 2000 - 2002 with the objective of understanding the initial colonization of the area

during the Late Pleistocene period (O'Connor *et al.* 2002, O' Connor and Veth 2005). O' Connor and colleagues (O'Connor *et al.* 2002) conducted test excavations in Lene Hara Cave, previously excavated by a Portuguese team directed by Antonio de Almeida (Almeida and Zybszweski 1967). Lena Hara is a solution cave in raised limestone about one kilometer from the current coastline. During the 2000 test excavation, the team observed at least two phases of occupation. The bulk of the deposit contains flaked chert artefacts, shells and animal bones. Radiocarbon determinations for the lower deposit are between 30,110± 320 uncal BP (ANU 11398) and 34,650± 630 uncal. BP (ANU 11418), both on *Strombus luhuanus* shel (O'Connor *et al.* 2002:48). Late Neolithic materials directly overlie this Pleistocene deposit. Pottery was recovered from the top 25 centimeters and associated with continuing stone artefacts, shells, and animal bones.

Leang Burung 2

Leang Burung 2 was excavated by Glover's team in 1975 and contains an upper Palaeolithic assemblage dated to 19,000 ± 250 uncal. BP (BM-1492) and 27,645 ± 200 uncal. BP (GRN-8292), both determinations on freshwater shells (Glover 1981:16). The bulk of the stone artefacts are flakes, with some exhibiting edge gloss, and waste flakes. There are a few distinct retouched flakes and points that show a relatively advanced stone technology, that Glover has identified as Levallois (or Levallois-like). Glover suggested (1981:29) that the Levallois character of the technology was an independent local invention. The upper and disturbed layers of Leang Burung 2 also contain small earthenware sherds with paddle stamped decoration.

Northern Moluccas

Bellwood directed a number of archaeological excavations in the northern Moluccas from 1990 to 1996. These included the islands of Morotai, Gebe and Halmahera (Bellwood *et al.* 1998). The geographic location of these islands is important since they lie between the southern Philippines, Sulawesi and New Guinea.

Tanjung Pinang and Daeo Cave 2

In southern Morotai Island two sites were excavated: Tanjung Pinang and Daeo Cave 2. Tanjung Pinang has two depositional layers; the upper archaeological layer which has a basal date of 10,000 BP, and the lower archaeologically sterile shell deposits dating to 37,510± 650 uncal. BP (ANU 7783), on marine shell (Bellwood *et al.* 1998:338). The upper layer has

a preceramic deposit, dating between 3390± 70 uncal. BP (ANU-7778) and 8860± 100 uncal. BP (ANU 7782), both on marine shell. This preceramic deposit contains pitted stones, unretouched flakes, and flaked pebbles tools. Above it, the ceramic deposit has incised earthenware sherds as well as human burials dating to 2090 ± 180 uncal. BP (ANU 8439) on human bone.

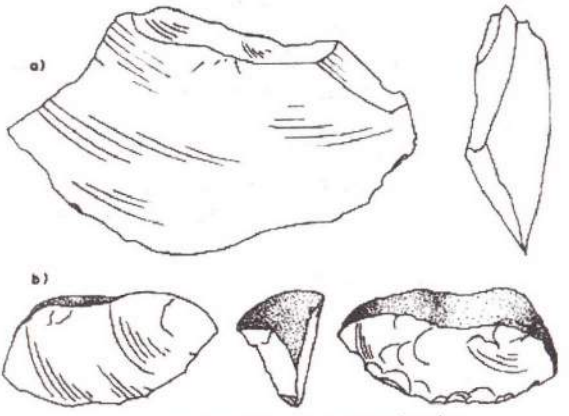
At Daeo cave 2 a similar cultural assemblage was excavated. Incised pottery similar to that at Tanjung Pinang pottery was found on the ground surface. The deposit contains a mainly preceramic assemblage of stone flakes and manuports, ochre, bone points and cooking stones. Faunal remains consist of cuscus (*Phalanger)*, fish bones, and shellfish. This assemblage is dated to between 5530± 70 uncal. BP or 6470-6170 cal. BP (ANU 9452) and 13,930 ± 140 uncal. BP (ANU 9450) on charcoal and marine shell respectively (Bellwood *et al.* 1998:339).

Golo Cave

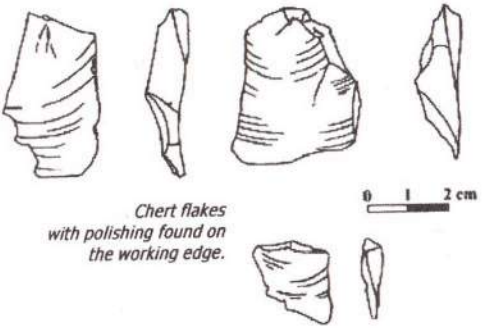
Golo Cave is located in Gebe island, just east of Halmahera. This is a cave site with a good stratigraphic sequence. The lowest preceramic assemblage has been divided into three phases. The oldest phase is dated to 32,210±320 uncal. BP (Wk-4629) on marine shell and contains flaked lithics, volcanic cooking stones and a relatively high volume of marine shells. The middle phase also contains flaked stone artefacts and volcanic cooking stones, but has a lesser volume of marine shell. This phase has a number of shell adzes made from *Tridacna gigas* and *Hippopus*. These adzes were initially estimated to date between 13,000 and 8000 BP (Bellwood *et al.* 1998, Tanudirjo 2001), but more recent AMS dating of the shell indicates that all are probably of Holocene age (Bellwood 2005). The upper phase is dated to 7400± 110 uncal. BP (ANU-9449) on marine shell (Bellwood *et al.* 1998:339). This upper phase is a rich shell midden deposit with bone points, flake stones, volcanic cooking stones, and ochre. Identified faunal remains were cuscus, wallaby, fish bones, birds, and reptiles.

Leang Sarru

In northern Sulawesi, the most pertinent rockshelter site is Leang Sarru (Bellwood 1979, 1997, Glover 1977, Tanudirjo 2001). Leang Sarru on Salebabu Island (Talaud) was excavated by Tanudirjo (2001, 2005). The lowest layer has a pre-Neolithic assemblage of flakes and blade-like flakes made from chert, and basaltic hammer stones. The stone implements were found associated with shellfish, dated to 29,590 ±630 uncal. BP (ANU-10498) on *Turbo* shell (Tanudirjo 2001:264). The next layer is dated between 9,750 ±90 uncal. BP (ANU-10203) and 18,880± 140 uncal. BP (ANU-10960),



a.) A large chert flake with polishing found on the edge. b.) A high angle scraper with retouching.



Chert flakes with polishing found on the working edge.

Figure 3: Tabon Cave chert flakes from 2001 excavation (Mijares 2004)

again on *Turbo* shell Tanudirjo (2001:264). The site was used as a lithic workshop during this second period.

Palawan and Luzon

Tabon Cave

Tabon Cave on Lipuun Point, Palawan, excavated by Robert Fox (1970:24) in the early 1960s, has yielded the oldest human remains found in the Philippines so far. Initially, the Tabon mandibles and skullcap were dated to 23,200 ±1000 BP (UCLA 699) on charcoal from associated strata (Fox 1970). Recent direct dating of the skullcap fossil using uranium series

provides a revised age determination of 16,500 +/-2,000 BP (Dizon 2003:65). The Tabon Cave lithic assemblage is primarily flake tools (Figure 3) made from chert. Fox (1978:64) observed that there was no basic change in the method of manufacture of the flaked artefacts during the entire inhabitation of Tabon Cave.

Recent re-excavation of Tabon Cave (Detroit *et al.* 2004, Dizon 2003, Dizon *et al.* 2002) has resulted in the recovery of twelve new human bone fragments. A tibia fragment has been dated to 47,000 +/- 11-10,000 BP using uranium-series analysis (Dizon 2003:65). This joint French-Filipino endeavor has also resulted in further physical analysis of the human remains. The initial assessment of metrical dimensions could suggest a presence of two distinct groups of people.

Callao Cave

The earliest securely dated lithic assemblage in Luzon is at Callao Cave, within the Cagayan Valley municipality of Penablañca. Stone tools were mainly manufactured on chert (Figure 4). The flakes were manufactured with simple percussion techniques. However, the recovery of more blade-like flakes in the preceramic period in Callao Cave could signify some variation in the lithic tradition through time. The possible evidence for a use of spear or arrow points from two blade-like flakes hints at a more formal lithic technology. Unfortunately, we do not have evidence yet from the Philippines for stone points made with the prepared platform techniques reported by Glover from late Pleistocene Leang Burung 2 in South Sulawesi, or the bifacial techniques reported by Bellwood for the Tingkayu industry from Sabah, or the backing and serrating techniques used in the Holocene Toalian industry of South Sulawesi (Bellwood 1988, Glover 1977, 1981). Callao Cave is also the only Cagayan Valley assemblage dating to ca. 25,000 BP found so far. The assemblage is also small thus limiting our analysis and interpretation. We need to verify this lithic technology in other cave sites of the same time period.

Around 6000 BP, there was a change in Cagayan to using both chert and volcanic rocks, particularly andesite (Mijares 2001, 2002). The Pinacanauan de Tuguegarao River, which bisects the Callao Limestone Formation, carries many cobble-sized volcanic rocks from outcrops in the Sierra Madre. Most of the flakes, especially those of andesite, carry varying amounts of cortex. The cortical surface of each pebble was probably used as striking platform in producing these flakes. This can be seen because most flakes have cortexed striking platforms. The addition of volcanic rocks might signal a diminishing access to chert raw material in the area.

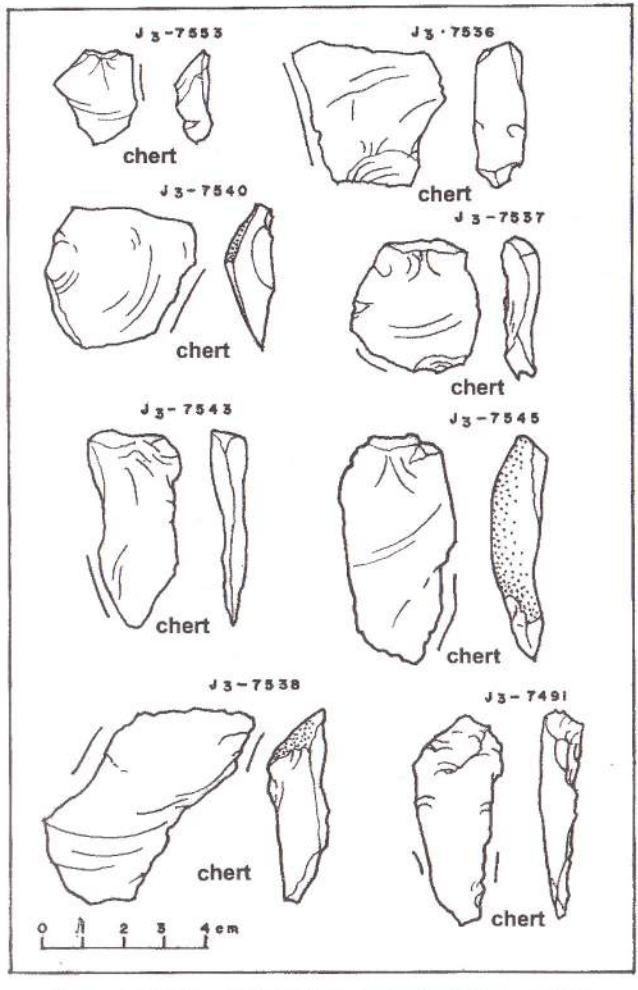


Figure 4. Callao 25,000 BP flake tools (Mijares 2005)

Late Pleistocene

The archaeological record of the Pre-Last Glacial Maximum (PLGM) Upper Pleistocene period, from 40,000 to 28,000 years ago in Southeast Asia, is highly dependent on cave sites. Movius' chopper/

chopping tool industry of the mid to late Pleistocene has been placed in serious uncertainty through archaeological research during the past three decades (Movius 1944, 1948, Reynolds 1993). The previous view of Movius, favouring a predominance of pebble tools, cannot be substantiated in all circumstances. Several Pleistocene archaeological sites, such as the lower layers of Long Rongrien, Lang Kamnan, Nguom, Niah, Kota Tampan, Tingkayu, Lena Hara, Leang Sarru, Leang Burung 2, Golo, Keplek and Tabon, have flake tools as the main lithic component, with a few pebble tools. As argued by Anderson (1990:69): "Upper Pleistocene archaeological sites that are securely dated are characterized by flake tools."

The flake industry during this period is generally made using simple percussion with minimal modification. There are a few sites that developed more formal tool forms. Leang Burung 2 has Levallois preparation of striking platforms and Tingkayu has lanceolate bifaces. Since these forms do not occur elsewhere in Southeast Asia, Glover (1981) for Leang Burung 2 and Bellwood (1997) for Tingkayu think that these lithic technologies are local developments, probably adaptive strategies in specific environments.

Although simple unmodified flakes were the most common lithic artefacts, there are occasional retouched flakes and/or blade-like flakes. Some flakes were modified to suit a particular function, such as high angle scrapers, tanged points and knives. Ian Glover (1977, 1981) stated that the Late Pleistocene in eastern Indonesia (or Island Southeast Asia generally) witnessed the development of relatively advanced stone working techniques, in stylistically diverse traditions.

Kealhofer's (2003) reconstruction of the Malay Peninsula environment during the late Pleistocene points to mosaics of savannah and woodlands. The hunters and gatherers of the Upper Pleistocene were involved in broad- spectrum subsistence, exploiting different terrestrial, riverine and marine ecological zones. The range of animals recovered in archaeological sites shows that these prehistoric humans were trapping animals from the forest canopy, including birds, squirrels, and macaques. Terrestrial animals hunted included pigs, deer, bovids, rhinoceros, crocodiles and elephants. Shellfish, either from rivers or the sea, were a regular source of protein. Most sites contain at least some shell midden. There is also evidence, as in Niah that people exploited a number of plant foods, such as wild yams, legumes, seed, nuts and fruits, and as such, it has been suggested that

> *the implication of the Niah evidence is that* Homo sapiens *groups who colonised south-east Asia were able to do so because they had developed ways of living in and off the variety of landscapes*

> *they encountered, including tropical rainforest, rather than being restricted to coastal ecologies* (Barker et al 2002:160).

Terminal Pleistocene to Early Holocene

The period between 18,000 and 6000 years ago saw the continuation of a broad-spectrum subsistence strategy by hunters and gatherers (Gorman 1971), still exploiting different ecological zones and different sizes of prey. This can be seen from the faunal remains that also show an opportunistic hunting strategy. As the sea level rose after the last glacial maximum and as Sundaland became submerged, some of these hunter-gatherers might have chosen to go inland and into the rainforest while some remained along the rich coastal areas. Latinis (2000) has suggested that hunter-gatherers began to incorporate arboreal subsistence during this period. "Arboreal-based economies were perhaps more 'sophisticated' by the late Pleistocene than is commonly assumed, as suggested by the practice of inter-island translocation of plant and animal resources" (Latinis 2000:50).

There are different patterns between mainland and island Southeast Asia in terms of lithic technology. On the mainland, different pebble stone technologies developed, starting with the Vietnamese Sonvian industry, followed by the Hoabinhian lithic industry as seen in the caves of Xom Trai, and Gua Gunung Runtuh, the middle layer of Lang Rongrien, and the lower layers of Spirit Cave, Gua Peraling, Gua Chawas and Gua Cha.

Ha Van Tan (1997) attributed the change from flake tools to pebble tools as an adaptation to changing climate. According to Kealhofer (2003:77), after the last glacial maximum, the sea level rose, submerging much of low-lying Sunda and Sahul. The rainforest environment expanded and there was a need for the use of pebble tools, probably to manage the forest through limited clearing.

A different story can be inferred from the lithic industry of the islands, where flake tool assemblages persist, with relatively very few pebble tools. Sites such as Tabon, Niah, Ulu Leang, Tanjung Pinang, Daeo 2 Cave, the lower layers of Keplek and Pondok Silabe, and Callao Cave are still dominated by flake tool assemblages. The Cabalwanian Industry in the Cagayan Valley (though the dating is still problematic, but most probably Terminal Pleistocene) that was once thought to be mainly a pebble tool industry, has actually more flake tools than pebble tools (Wasson and Cochrane 1979).

Discussion

The comparative analysis of the different lithic technology in Southeast Asia during the Late Pleistocene to Early Holocene can be used to infer human movement. The analysis shows the flake tool technology that dominated Mainland Southeast Asia (including Sundaland) spread into Island Southeast Asia during the Late Pleistocene.

Modern humans might have used sea craft to cross the narrow channels from Sundaland (including Palawan) into the different islands. Building a raft requires only a simple technology, according to Atholl Anderson (2000:15), in which "a rough-edge stone knife and some ability in using stripped bamboo as cordage are the only technological requirements for building a seaworthy and durable craft capable of carrying a group of people and their baggage."

The migration into Luzon might have come from Palawan. Palawan Island is part of the former Sundaland continent, which is now partly submerged as a result of sea level rise after the last glaciation. The chert assemblage from the lower layer of Callao cave could easily fit within the Tabonian tradition in terms of technology and use-wear (Mijares 2004, 2005). We can then infer that the oldest discovered hunters and gatherers of Luzon probably migrated via Palawan at least 30,000 years ago or older.

The early migration into the islands is a punctuated event rather than a continuous migration and interaction between Mainland and Island Southeast Asia. If there were continuous interactions, then we could have seen the spreading of Hoabinhian type of stone implements into Island Southeast Asia, which we did not. By the end of Pleistocene period, core tools such as the Hoabinhian type dominated Mainland Southeast Asia. On the other hand, the flake tool industry persisted in Island Southeast Asia until the arrival of stone adzes during the Neolithic period.

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Abstract

Globalisation probably started when modern humans ventured across land and sea, and populated the world. The region we now call Southeast Asia was possibly populated by modern humans at around 50,000 BP or earlier. When and how early modern humans reached Island Southeast Asia have been problematic. The reason for this is that archaeological visibility for sites during this time period is scanty. Most of the sites during the Upper Pleistocene in and around the Sundaland became submerged when the sea level rose at the beginning of the Holocene period. This paper presents current archaeological literature in the Mainland and Island Southeast Asia and new archaeological research in northeastern Luzon in order to trace the movement of people. Archaeological record of Mainland Southeast Asia during the Upper Pleistocene (40,000-28,000 BP) shows the predominance of flake tools. But during the Terminal Pleistocene to Mid Holocene (18,000-6000 BP) there was a drastic change towards the predominance of pebble tools called Hoabinhian stone tools.

A different story can be seen in Island Southeast Asia, the flake tool assemblage persisted from the Upper Pleistocene to the Mid-Holocene period. No Hoabinhian type stone implement has been found in Island Southeast Asia except in Formosa (15,000 BP). Human migration into Island Southeast Asia might have occurred during the Upper Pleistocene when the flake tool technology dominated in Mainland Southeast Asia. This migration into the islands is a punctuated event rather than a continuous migration and interaction between Mainland and Island Southeast Asia. If there were continuous interactions, then we would have seen the spreading of Hoabinhian type stone implements into Island Southeast Asia, which we did not. The beginning of interaction between communities and formation of network commenced when a new group of people ventured out, bringing with them a different subsistence strategy and cultural materials during the Neolithic period.