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Hunter-Gatherers in Southeast Asia: From Prehistory to the Present

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Abstract

Anatomically modern hunter-gatherers expanded from Africa into Southeast Asia at least 50,000 years ago, where they probably encountered and interacted with populations of *Homo erectus* and *Homo floresiensis* and the recently discovered Denisovans. Simulation studies suggest that these hunter-gatherers may well have followed a coastal route that ultimately led to the settlement of Sahul, while archaeology confirms that they also crossed significant seas and explored well into the interior. They also adapted to marked environmental changes that alternated between relatively cool and dry conditions and warmer, wetter interludes. During the former, the sea fell by up to 120 m below its present level, which opened up a vast low-lying area known as Sundaland. Three principal alignments can be identified: the first involved the occupation of rock shelters in upland regions, the second has identified settlement on broad riverine floodplains, and the last concentrated on the raised beaches formed from about five millennia ago when the sea level was elevated above its present position. This cultural sequence was dislocated about 4 kya when rice and millet farmers infiltrated the lowlands of Southeast Asia ultimately from the Yangtze River valley. It is suggested that this led to two forms of interaction. In the first, the indigenous hunter-gatherers integrated with intrusive Neolithic communities and, while losing their cultural identity, contributed their genes to the present population of Southeast Asia. In the second, hunter-gatherers withdrew to rainforest refugia and, through selective pressures inherent in such an environment, survived as the small-bodied, dark-skinned humans found to this day in the Philippines, Peninsular Malaysia and Thailand, and the Andaman Islands. Beyond the impact of expansive rice farmers in Melanesia and Australia, hunter-gatherers continued to dominate until they encountered European settlement.

Keywords

Hoabinhian, Mani, Semang, Southeast Asia, Hunter-Gatherers, Sundaland

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CHARLES HIGHAM¹

Abstract Anatomically modern hunter-gatherers expanded from Africa into Southeast Asia at least 50,000 years ago, where they probably encountered and interacted with populations of *Homo erectus* and *Homo floresiensis* and the recently discovered Denisovans. Simulation studies suggest that these hunter-gatherers may well have followed a coastal route that ultimately led to the settlement of Sahul, while archaeology confirms that they also crossed significant seas and explored well into the interior. They also adapted to marked environmental changes that alternated between relatively cool and dry conditions and warmer, wetter interludes. During the former, the sea fell by up to 120 m below its present level, which opened up a vast low-lying area known as Sundaland. Three principal alignments can be identified: the first involved the occupation of rock shelters in upland regions, the second has identified settlement on broad riverine floodplains, and the last concentrated on the raised beaches formed from about five millennia ago when the sea level was elevated above its present position. This cultural sequence was dislocated about 4 kya when rice and millet farmers infiltrated the lowlands of Southeast Asia ultimately from the Yangtze River valley. It is suggested that this led to two forms of interaction. In the first, the indigenous hunter-gatherers integrated with intrusive Neolithic communities and, while losing their cultural identity, contributed their genes to the present population of Southeast Asia. In the second, hunter-gatherers withdrew to rainforest refugia and, through selective pressures inherent in such an environment, survived as the small-bodied, dark-skinned humans found to this day in the Philippines, Peninsular Malaysia and Thailand, and the Andaman Islands. Beyond the impact of expansive rice farmers in Melanesia and Australia, hunter-gatherers continued to dominate until they encountered European settlement.

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KEY WORDS: HOABINIAN, MANI, SEMANG, SOUTHEAST ASIA, HUNTER-GATHERERS, SUNDALAND.

There are three regions where small-statured (“negrito”) hunter-gatherers survive in Southeast Asia: the Andamanese of the Andaman Islands, the Semang and Mani of Peninsular Thailand and Malaysia, and the Aeta of the Philippines (Figure 1). In the following review, they will be referred to as Andamanese, Semang, and Aeta although each contains several subgroups. Andamanese and Semang haplogroups not only have a deep indigenous ancestry but also link with an original movement of anatomically modern humans (AMHs) from Africa. This stems from the finding that the lineage L3 is the parent African base for the expansion of AMHs out of Africa; it was lineage M and its descendants that dominate the ancient haplogroups in Southeast Asia (Oppenheimer 2012). The new molecular clock dating for this exit from Africa straddles the Toba eruption of ~74 kya, but archaeologically a date later than this is more likely than one that preceded it (Soares et al. 2009). The Semang, which present the most consistent negrito phenotype in their area, have a high proportion of indigenous lineages seen in M21a, M21b, and R21 (Hill et al. 2006; Oppenheimer 2011).

Archaeologically, there is a growing body of evidence that initial settlement was under way by 50–60 kya. Mijares et al. (2010) have recovered a small hominin metatarsal from Callao Cave on the island of Luzon that has been dated to about 60 kya (see also *Détroit* this issue). The location of this site, where it would have been necessary to make a significant sea crossing to reach the island, emphasizes the innovative flexibility of early humans during that period. Bones from AMHs also have been traced at Tabon Cave, dated to at least 30 kya.

Tam Pa Ling, meaning Monkey Cave, is in rugged karst terrain in the remote uplands of northeastern Laos. Sixty-five meters into the cavern, a trench was opened in 2009–2010, and the remains of a human cranium were found there at a depth of 2.35 m (Demeter et al. 2012). Although not complete, the skull and upper teeth belonged to an AMH. This individual did not live in the cave interior, but the bones were washed down into this abyss, along with fragments of charcoal. The resulting radiocarbon determinations lie at the upper limit for this dating technique and suggest that the charcoal dates are ~56.5 kya. Thermoluminescence and optically stimulated luminescence (OSL) dates on the sediments in which the bones were found place the fossils between 46 and 51 kya. A direct date on the bone itself by the U/Th technique results in a determination of 63.6 ± 6 kya. Overall, there is therefore a minimal estimate of 46 kya and a maximal estimate of about 63 kya, making this the earliest definite AMH in mainland Southeast Asia. A remarkable feature of this important discovery is that the individual had been living in a remote upland region, far from the coastline, which has, for a long time, been seen as the most logical route for the expansion of AMHs into Southeast Asia.

By crossing the land link between Sumatra and Borneo and following the coastal route to the northeast, one comes to the massive cave complex of Niah. It was here that excavations between 1954 and 1967 encountered a human cranium now known as the “Deep Skull” (Harrisson 1958). The bone is relatively thin, while certain features, such as a broad nasal opening and a moderate extension

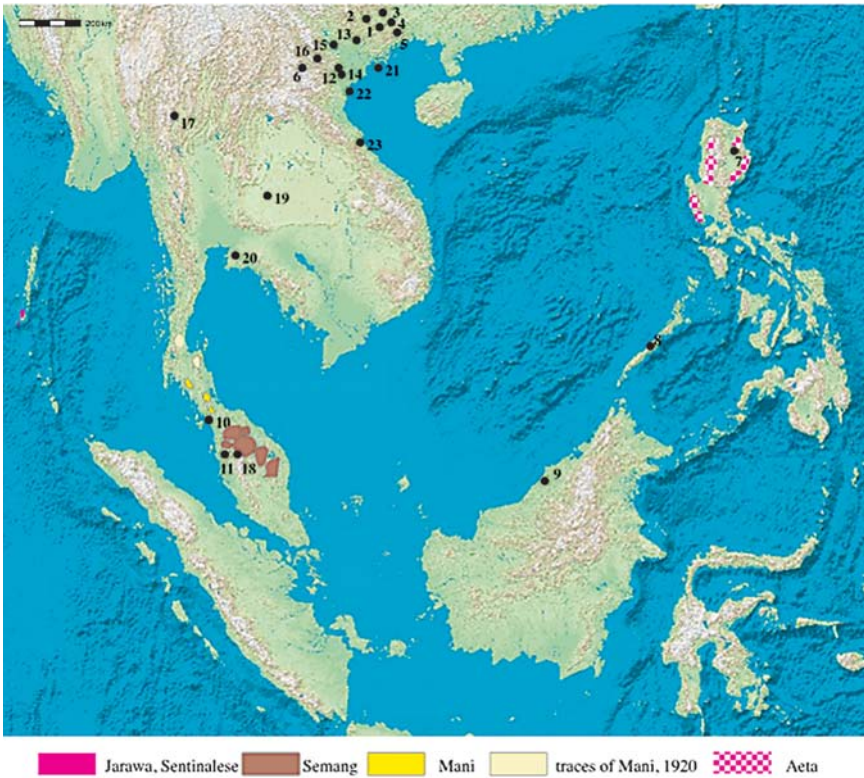


Figure 1. The location of modern negrito hunter-gatherers and the prehistoric sites mentioned in the text: 1, Chongtang; 2, Gexinqiao, Baida, Kantun; 3, Beidaling; 4, Datangcheng; 5, Dingsishan; 6, Tam Pa Ling; 7, Callao Cave; 8, Tabon Cave; 9, Niah; 10, Lang Rongrien, Moh Khiew, Sakai; 11, Bukit Bunuh, Gua Gunung Runtuh; 12, Dieu Cave, Sung Sam; 13, Nguom, Mieng Ho; 14, Con Moong; 15, Son Vi; 16, Da Phuc; 17, Tham Lod Ban Rai; 18, Gua Cha; 19, Ban Non Wat, Noen U-Loke, Ban Lum Khao; 20, Nong Nor, Khok Phanom Di; 21, Cai Beo; 22, Man Bac, Da But, Con Co Nguu; 23, Bau Tro.

of the mouth area, indicate that it could well be ancestral in form to the modern hunter-gatherers and Australian Aborigines. Higham et al. (2009) have shown that Niah was occupied by at least 45 kya. Because there is evidence for human activity 50 cm below the earliest dated layer, this figure is conservative.

The cultural layers associated with this early settlement of the cave suggest that there were intermittent phases of a relatively brief occupation. Hearths and food residue reveal that the principal game was the pig, with nearly 30% of bones identified, followed by the monkeys with 16%. Other ground-dwelling species include the large sambar deer, the smaller muntjac, and the tiny mouse deer, as well as the occasional bovid, porcupine, and pangolin. Arboreal species are less common, but orangutans and squirrels were hunted, and 64 bird bones were

identified. The early inhabitants also collected turtles and tortoises. Indeed, it seems that they set a pattern that was to continue into the foreseeable future—a broad collecting spectrum of virtually any edible quarry. However, the lack of marine species suggests that, with a lowered sea level, the shore was some distance north of the site. This is supported by the pollen spectrum for this early settlement phase because only toward the end was there significant evidence for mangroves. The dominant trees represent a drier forest than the present wet tropical regime, with some relatively open areas where one would expect to find the deer and bovinds that were hunted and returned to the cavern.

One recurrent feature of the stone industries, including that of Niah, is the lack of any obvious hunting weapons. Rather, the wear patterns on some of the stone flakes suggest that they were used to manufacture or treat bamboo. This remarkable resource can be converted into light and highly effective weaponry but does not survive for long in the archaeological record. The importance of plant food should not be overlooked. Microscopic residues from various fruits and nuts, as well as sago palms, have been identified. Barton (2005) has also found evidence for the presence of yams and taro through the survival of diagnostic starch grains.

East of Java, there was a chain of intervisible islands to Timor, beyond which lay a considerable stretch of open sea, the passage to Australia. We now know that AMHs were able to cross this barrier by at least 45 kya (O'Connell and Allen 2004). This context is further matched by the radiocarbon determinations from occupation sites in the Ivane Valley in eastern New Guinea. Here, at an altitude of 2,000 m, AMHs were exploiting yams and pandanus, hunting, and making stone tools between 43 and 49 kya (Summerhayes et al. 2010). The expansion farther east was not only rapid, but reaching New Britain and New Ireland necessitated sea crossings of up to 50 km. Occupation at Buang Merabak on New Ireland has been dated to between 43 and 45 kya, and at Matenkupkum, 39 and 41 kya. The same span has been identified at Yombon, inland from the coast of New Britain (Summerhayes and Ford in press).

The Mainland of Southeast Asia. Lang Rongrien is a large cavern in peninsular Thailand with an early cultural sequence below a thick rock fall that incorporates three successive occupation floors (Anderson 1990). These were composed of hearths fashioned by clearing stones to form a circle, together with charcoal fragments, stone artifacts, and charred fragments of bone. The lowest had two hearths, broken fragments of bone, and 45 stone artifacts (mainly of chert). Unit 9, above this lens, incorporated three hearths, scatters of broken and unidentifiable bone, and 21 stone artifacts. Charcoal from this occupation lens has provided a radiocarbon determination of about 38 kya, not long after the initial occupation of Niah Cave, whereas Unit 8 with seven hearths and concentrations of charcoal and stone flakes has been dated again on the basis of charcoal to 27 kya.

Bukit Bunuh is a large, open workshop site in the Lenggong Valley of Malaysia; the detritus from the manufacture of stone artifacts covers an area of at least 3 km² (Saidin 2006). According to an OSL date, the site was in use by about

40 kya. The waste flakes from tool manufacture retain a sharp edge, suggesting that they were found without disturbance in their original location. This is confirmed by the presence of many anvils and hammer stones used in the process of removing flakes from their parent stone core. Nearly half of the analyzed artifacts were made on flakes of stone, but there are also a few tools formed by removing flakes from both sides of the cobble and providing a pointed end.

In northern Vietnam, three groups of sites have been identified that illustrate early human settlement: Dieu (from 30 kya), Nguom (>23 kya), and Son Vi (~23–13 kya). The Dieu industry is characterized by the striking of flakes from the parent stone core (Nguyen Gia Doi 1999). Radiocarbon dates indicate an age of at least 30 kya and then a continuation into the Holocene period. Early occupation has also been identified at the rock shelter of Mieng Ho and the cave of Nguom in the uplands of Bac Thai Province (Quang Van Cay 1995). Excavations at the latter in 1980–1982 uncovered two layers stratified under Son Vi material, characterized by small stone scrapers and points, as well as some pebble core tools (Ha Van Tan 1997; Reinecke 1998; Trinh Nang Chung 1998).

The lowest of the three levels at Con Moong, a rock shelter within the Cuc Phuong upland, contains stone tools of a Son Vi type. Son Vi stone assemblages consist of quartz pebbles flaked along one surface to create a working edge. This meant that much of the original surface of the cobble remained in place. Ha Van Tan (1976) has distinguished, apart from the flakes that result from the manufacture of stone tools, four main types of artifact. One is the large quartzite cobble with a transverse cutting edge, which he feels were used as choppers and/or scrapers. The second has a cutting edge on the longitudinal edge of the tool. These side choppers or scrapers normally make up the majority of implements found in Son Vi sites. There are also a few implements with flaking on two working surfaces and lastly, pebbles with flaking along only one edge, termed “round-edged pebbles.”

Apart from the Andaman Islands, all the regions of Southeast Asia in which small-statured hunter-gatherers have survived to the present day have provided evidence for initial settlement by AMHs earlier than 30 kya.

The Hoabinhian. Caves are easily found, and they often contain evidence for settlement by prehistoric hunter-gatherers. This has led to a serious bias in favor of portraying all hunter-gatherers in Southeast Asia as transient, small in scale, and socially egalitarian. During the last glacial maximum and the subsequent period of global warming, the inland rock shelters and caves were occupied by hunter-gatherers usually combined under the generic term “Hoabinhian.” If we examine the adaptation in peninsular Thailand and Malaysia of the modern hunter-gatherers Semang and Mani to a similar forested environment as that reconstructed for the Hoabinhian, we find that rock shelters are but one component of their occupation strategy. During the relatively dry season, the Mani prefer to live in temporary encampments in the cool rainforest, retreating to cave shelters only during the period of rains (Figure 2; Endicott 1999). Their shelters are made from bamboo, leaves, and tree bark and are ephemeral. On abandonment, they



Figure 2. A Mani camp in Southern Thailand (image courtesy of Dr. G. Albrecht).

would leave few traces for a future archaeologist—only their stone-lined hearths and discarded durable artifacts would survive. Their subsistence is best described as a broad spectrum, involving forest fauna such as gibbons, macaques, and squirrels hunted with blowpipes, along with fish, shellfish, and a wide range of plants (Endicott 1999). Discovering a dry-season camp occupied 10 kya would rely on luck, whereas identifying a rock shelter requires judgment. We could thus think of characterizing the inland Hoabinhian as being subjected to the tyranny of the rock shelter, and the results are almost certainly biased.

Colani (1927), who was instrumental in first investigating relevant sites (Figure 3), noted that the people had a hunting and food-gathering economy, struck stone tools from river cobbles, and hunted animals that survive to this day. Sung Sam, a typical Hoabinhian rock shelter located about 100 m above its valley floor, contained occupation layers 1.4 m deep, and excavations by Tran Quoc Vuong in 1974 encountered stone tools, animal bones, and the remains of shellfish collected from the nearby streambed. Typical stone implements center on a tool known as the sumatralith (Figure 4). This was made by removing flakes from one side of a river cobble. The modification of such river pebbles by flaking forms the basis of the Hoabinhian stoneworking tradition. The range of tools was limited. Apart from the sumatralith or unifacial discoid, there is the simple removal of a row of flakes along one edge of a pebble to form a cutting edge. More common are “short axes,” artifacts modified to form a convex cutting edge at one end. Although stone artifacts are the most abundant, there was also a bone industry, as evidenced at the Da Phuc rock shelter, where most of the 105 bone tools are composed of points or awls.



Figure 3. Early excavations by Colani at a Hoabinhian rock shelter (image courtesy of The École française d'Extrême-Orient).



Figure 4. Hoabinhian stone artifacts (image courtesy of Dr. R. Shoocondej).

Hoabinhian rock shelters have now been traced from the eponymous province of Hoa Binh in Vietnam across the Truong Son Cordillera into the uplands of Laos and Northern Thailand, down to Kanchanaburi and into the peninsular and again in western Cambodia, Malaysia, and Sumatra. Several advances have been made since the pioneer years of Colani. Gorman (1971) pioneered the fine screening of cultural deposits, leading to the recognition that a wide range of plants was collected, while identifying reliable sequences has shown that over time some stone tools were ground and polished. Continuing Gorman's fieldwork in Northern



Figure 5. The rock shelter of Tham Lod (image courtesy of Dr. R. Shoocondej).

Thailand, Shoocondej (2006) has excavated the cavern of Tham Lod, where deep deposits of cultural remains were revealed, the oldest stretching back to at least 35 kya (Figure 5; Shoocondej 2004, 2008), when the climate was cooler than today. As at Spirit and Banyan Valley caves, the hunter-gatherers lived near a stream from which the inhabitants hunted the local wild cattle, pig, and deer. They also fished and collected large quantities of shellfish. Several different environmental zones were exploited, including the canopied evergreen forest and the river margins.

In one part of the cave, there were hearths and evidence for habitation, but in another, hearths were absent, and the area was used for the manufacture of Hoabinhian stone tools, including typical sumatraliths and short axes, while hammer stones were abundant. After ~15,000 BC, the cave was used for burying the dead. Four skeletons were uncovered (Pureepatpong 2006). One adult, dating to about 12 kya, was found in an extended position that was associated with shellfish. An adult female, who died when ~25–30 years of age, was interred in a flexed position, and the radiocarbon determination suggests that she was interred about 13.5 kya. A hammer stone had been placed over the skeleton as a ritual offering.

Ban Rai is a second rock shelter that lies only 10 km southwest of Tham Lod, and excavations there have also revealed Hoabinhian occupation (Shoocondej 2004, 2008; Treerayapeewat 2005). It is a large and impressive site, again located close to a stream as it cascades into a sinkhole. Paintings are an important feature of this site. There are images of animals and human figures, and some symbols. It is not possible to obtain a date for these paintings, but they might well have been the work of the Hoabinhian hunter-gatherers. Ashy layers incorporate stone tools, shellfish, and the bones of hunted animals. A tightly flexed human burial of an old man in a round pit dates to about 10 kya (Figure 6).

Farther south at the caves of Sakai, Moh Khiew, and Lang Rongrien in peninsular Thailand, we encounter the same pattern. At Sakai Cave, a modern hunter-gatherer occupation overlies prehistoric deposits up to 2 m thick that



Figure 6. Hoabinhian burials are very rare. This flexed skeleton of an old man from the Ban Rai rock shelter dates to about 10 kya (image courtesy of Dr. R. Shoocondej).

date back to 10 kya and includes a number of hearths and the stone tools used to process game and to fashion wooden implements. The animals hunted from this base include gibbons, squirrels, macaques, and civets, denizens of the canopied rainforest. Freshwater shellfish and some marine shellfish were collected, the latter having to come from a 30-km distance. At Moh Khiew, Pookajorn has recovered evidence for Hoabinhian stone tools associated with four inhumation burials, one of which may have been interred in a seated, crouched position. A radiocarbon date suggests that one of the burials is about 25,000 years old (Pookajorn 1994). Unfortunately, only part of the upper body has survived. The other three were all extended inhumations on a north-to-south orientation. Grave goods consisted of flaked stone tools and quartz pebbles. Upper cultural contexts at the vital site of Lang Rongrien contain stone tools that fall within the range for the Hoabinhian hunter-gatherer culture dated between 10 and 6 kya, with flaked core tools such as choppers and axes present.

Across the border in Malaysia is an area still occupied by the Semang hunter-gatherers and a classical area for early archaeological research into their prehistoric ancestors. One of the key sites is the cavern of Gua Cha, where excavations have revealed a two-stage cultural sequence, beginning with the Hoabinhian (Aji Haji Taha 1991). The occupation by hunter-gatherers probably lasted for several millennia: one radiocarbon date lies in the mid-seventh millennium BP, whereas a second determination shows that the cave was used as a Neolithic cemetery after about 3000 BP. The stone industry and biological remains reflect the usual set of flaked

tools including bifacially worked discoids, as well as a wide range of mammalian bones. Young pigs dominate, and there are also the remains of squirrels, gibbons, and monkeys that indicate a forested habitat. Freshwater shellfish were collected from the nearby stream. The most significant feature of Gua Cha is the use of the site for human burials. Fifteen Hoabinhian graves have been identified, the dead being invariably interred in a flexed position with a marked absence of mortuary offerings. One young man was buried, however, with his head resting on a large stone pillow. The assemblage includes a teenager, four women, and ten men. Apart from the teenager, six died as young adults, five when of middle age, and one when an old man (Bulbeck n.d.).

Gua Gunung Runtuh is a cavern located in the Lenggong Valley in Perak State. Excavations in 1990–1991 encountered the remains of a hunter-gatherer occupation that began, according to radiocarbon determinations on freshwater shell, about 13 kya. The site is elevated above the Perak River valley. The freshwater shellfish together with the fragmented and often charred animal bones reflect how broad-spectrum hunting and collecting sustained the hunter-gatherers who used this site for shelter over a period measured in thousands of years. Among the animal species represented, the wild pig is most abundant, followed by the langur and macaque (Davidson 1994). The large sambar deer and smaller muntjac were also hunted. Typically, there are no domestic dogs. Rare animals include the gaur (a large wild bovid), tapir, and Malayan bear. The hunters also brought back to the base tortoise, lizard, and turtle. The freshwater shellfish are adapted to clear rivers and the muddy base of jungle streams.

Gua Gunung Runtuh is notable for the recovery of a complete Hoabinhian burial, dated by radiocarbon to about 10 kya (Zuraina 1994). The man had been laid out on his back with his legs raised and flexed at the knees. The excavation revealed the rituals that attended this interment. Shells were scattered under the body, and more were placed over it. Bones from pig, deer, lizard, and monkey, some broken and charred, were found by the left arm, the right shoulder, and the foot. Stone tools, including a sumatralith, a limestone slab, and hammer stones, were placed with the corpse. These showed signs of use-wear, suggesting that they belonged to the dead man, who died at between 40 and 45 years of age. A detailed examination of this skeleton has revealed close similarities with those interred at Gua Cha, as well as with Aboriginal Australians. Matsumura and Zuraina (1999) have suggested that the skeleton represents an Australo-Melanesian population of hunter-gatherers of the same stock as those who much earlier crossed into and populated Australia.

The Inland Plains. The lowlands of Southeast Asia have undergone such changes caused by deforestation and alluvial deposition that, until very recently, the record of hunter-gatherer occupation has been a blank page. However, the natural resources would have been most attractive to human settlement. There are, for example, at least four species of deer, three native cattle, wild pigs, and myriad other potential food sources. Over the past few years, intensive fieldwork

in Guangxi Province of southern China has provided some insight into the nature of hunter-gatherer settlement there, while the northeastern Thai site of Ban Non Wat has furnished some evidence for the presence of hunter-gatherer occupation during the second millennium BC.

In Guangxi, 15 sites ascribed to hunter-gatherer groups that settled along the banks of rivers incorporate extensive workshops for the production of stone tools, but pottery sherds are relatively rare. The distribution covers an extensive area from Baise in the west to Guilin in the northeast, and south to Nanning and the Vietnamese border. In western Guangxi, stone workshops as well as burials were found at the sites of Gexinqiao (Xie et al. 2003) and Baida and Kantun (Xie and Peng 2006), which are all located near the Youjiang River and its tributaries and are dated from about 9 to 5 kya. In western Guangxi, Gexinqiao is an extensive site of which 1,600 m² have been excavated. It was occupied about 6 kya. Stone tools include flaked choppers, points, and scrapers, as well as polished adzes. All stages of manufacture are represented, so it was clearly a workshop site in which the distribution of the stone flakes, hammer stones, and anvils makes it possible to identify the position taken by each artisan. Pottery sherds are rare, and in the main they are simply cord-marked. Two tightly flexed human burials were found that were associated with large river cobbles.

In central Guangxi, along the Hongshui River, several sites have been excavated. Beidaling is the most important because a large stone workshop of over 1,600 m², and eight burials were found in the lower part of the deposits, which are dated to 8 kya. More than 50,000 stone artifacts were recovered from the stone workshop, including hammer stones, anvils, whetstones, flaked choppers, points, and scrapers, as well as polished adzes and axes. All stages of manufacture are represented, indicating a stone workshop site. Pottery sherds are rare (Lin and Xie 2005). In eastern Guangxi, five sites have been found along the course of the Xunjiang River. Datangcheng was excavated in 2006 over an area of 2,000 m². Again, we find a stone workshop with two periods of occupation, dated to 8 and 5 kya, respectively. There was a dense accumulation of stone flakes and artifacts in various stages of manufacture, including many adze roughouts, hammer stones, and whetstones. Much pottery was also found at this site, including large vessels with everted rims (Lin et al. 2007). There are several known sites along the course of the Yongjiang River in southern Guangxi, and at Chongtang, a group of 26 human graves has been uncovered in which the dead were interred in a tightly flexed position. Cowrie shells also provide evidence for exchange with coastal communities (He and Chen 2008).

The Yongjiang, Zuojiang, and Youjiang River terraces also incorporate many sites of the Dingsishan culture (Zhang and Hung 2010). From ~7 to 4 kya, this area of Guangxi was occupied by hunter-gatherers who led a relatively settled, sedentary life in settlements that, similar to Dingsishan itself, included living areas, a cemetery, and midden dumps. The cultural sequence is divided into four phases, with pottery occurring from the initial settlement. During phase 2, pottery was cord-marked, or impressed with basketry patterns. Groundstone adzes were

fashioned, and nearly half the shell artifacts were used as knives. The 16 burials were placed in a pit in a flexed or squatting position. The 133 burials from phase 3 at this site were interred in a flexed or crouched position, with very few mortuary offerings of stone, bone, or shell (Fu 2002). A particular feature of the phase 3 burials was the dismemberment of the body before burial, different parts of the corpse being carefully placed within the grave. The dismembered body in burial 117 was accompanied by 13 stone slabs. These people had a wide-spectrum subsistence base including hunting, aided by bone spearpoints and arrowheads. They fished, collected shellfish, and, in terms of their technology, made pottery vessels and used polished stone axes and adzes. In phase 2, a pottery workshop has been found at Baozitou in which the pots were cord-marked or ribbed, and the clay tempered with quartz or crushed shell. The similarities of the Dingsishan sites and those of the Da But and Bacsonian in northern Vietnam are so close that they must have been developing in tandem.

At the site of Ban Non Wat in northeastern Thailand, a cemetery of probable hunter-gatherers has been uncovered. Deep in the cultural sequence, flexed burials were encountered, associated with mortuary offerings that set them apart from the initial Neolithic graves in the same site (Higham and Kijngam 2011). One of the former lay typically in a flexed position, holding a complete pig's skull. A man and a woman had been interred next to each other, the man with a stone adze, a small pottery vessel, shell-bead necklace, and a bivalve shell. The woman wore a necklace of large shell beads, and a further bivalve shell lay beside her left shoulder. The shell has provided a radiocarbon determination of 1741–1531 cal BC. Another grave contained a woman with roughly shaped shell beads, holding an infant in her arms.

The important point about these inland sites is that Southeast Asia was well populated with different hunter-gatherer groups when the first rice farmers arrived from the north.

The Maritime Adaptation. The loss of land to the rising sea between 15 and 4.5 kya means that our knowledge of the adaptation of AMHs to a marine habitat is unavailable other than when raised beaches were formed when the sea rose higher than at present. In the Gulf of Siam region, two sites illustrate a quite different material culture to that characteristic of the Hoabinhian. Nong Nor was occupied in the mid-third millennium BC and was located on the shore of a marine embayment (Higham and Thosarat 1998). A thick-shell midden dominated the cultural level of a site that was probably occupied for a season only. This midden contained not only a wide range of shell species but also many fish bones. Among these, the bull shark and the eagle ray suggest that substantial vessels were taken out to the open sea. The inhabitants manufactured ceramic vessels and used polished stone adzes, and the one burial involved a woman interred in a seated, flexed position under ceramic vessels. There was no evidence for rice consumption, and no domestic animal bones were found.

A similar situation was found in the basal layers of Khok Phanom Di, which is located about 20 km to the north on the former estuary of the Bang Pakong River

(Higham and Thosarat 2004). Such tropical estuaries are ranked among the three most productive ecosystems known and provide opportunities for coastal exchange and easy contact with the hinterland. Again, we find that the first occupants, who came to the site in ~2000 BC, exploited the local shellfish beds and consumed fish and crabs. They made fine pottery vessels in a tradition that was to endure at this site for at least five centuries and used ground and polished adzes made from imported stone. One of the dead belonging to the first of seven mortuary phases (MPs) was interred in a flexed position, whereas the other five MP1 graves contained extended skeletons in a supine position.

The next two MPs involved clusters of graves laid out on a checker board pattern, each containing men, women, and many infants. It is thought that each cluster was contained within a mortuary structure and that the rituals involved feasting. Again, there is no evidence for local cultivation or the raising of domestic animals, although some exotic potsherds were made of a clay tempered with rice chaff.

This situation changed during MP3B when the sea level fell, and marine or brackish water indicators gave way to evidence for local freshwater habitats. It was at this juncture that we find a proliferation of shell knives used for harvesting (Higham 1993), granite hoes, and domestic rice in human feces and stomach contents. The probable date of this change is eighteenth or seventeenth century BC, a change also associated with the arrival into the site of a few women who came from a different environment and who were therefore not born or reared at Khok Phanom Di (Bentley et al. 2007). This episode did not endure: by MP5, the sea level rose again, making local rice cultivation marginal or impossible. The reversion to marine hunting and gathering was accompanied by a remarkable surge in mortuary wealth: one woman was interred wearing clothing encrusted with more than 120,000 nacreous shell beads, as well as shell disks, ear ornaments, and a bangle, along with several fine ceramic vessels, cylinders of clay destined for conversion into pots, and her tools of trade: a potter's anvil and burnishing stones (Figure 7). MP6 saw more wealthy women potters, two interred within a raised mortuary structure composed of clay walls and a clay floor. The site was finally abandoned as a coastal site in the vicinity of 1500 BC after being occupied continuously for ~20 generations.

There is a crucial issue relating to the affinities of the inhabitants of Khok Phanom Di: are they descended from the coastal hunter-gatherers of Sundaland or from intrusive Neolithic farming groups who originated in China? All attempts to extract DNA from the bones have failed. However, a multivariate analysis of the male cranial dimensions has shown a sharp difference between the people of Khok Phanom Di and those of two inland Neolithic sites, Ban Chiang and Non Nok Tha (Pietruszewsky 2006, 2010). This site should thus dispel any notion that the indigenous hunter-gatherers of Southeast Asia consisted of small and scattered mobile bands adapted in the main to the interior rainforests.

A related series of settlements, though not so rich in terms of mortuary evidence or cultural change over time, are documented along raised beaches in Vietnam. The sequence at Cai Beo began with stone tools of strong Hoabinhian affinities, together with pottery fired at a low temperature and decorated with

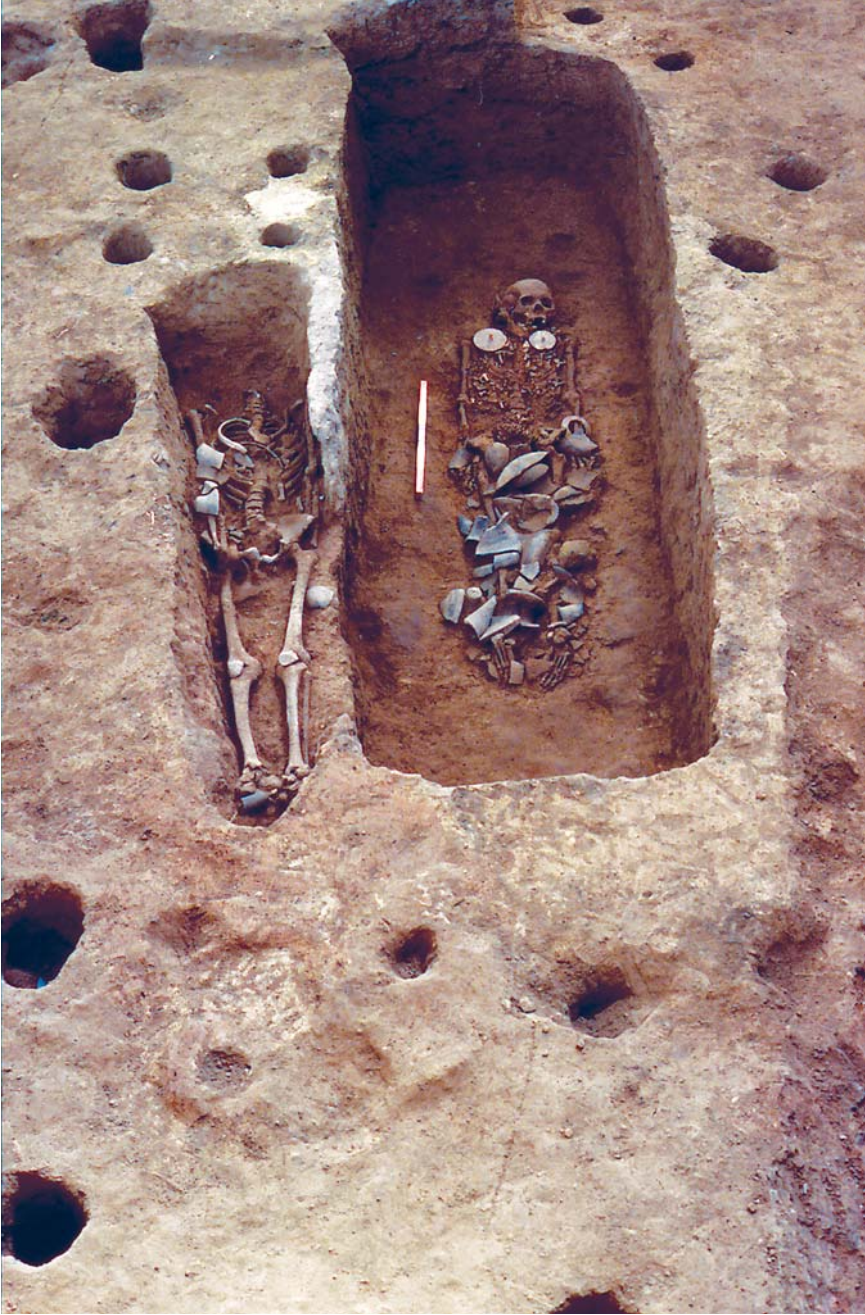


Figure 7. Burial 15 at Khok Phanom Di, an exceptionally wealthy hunter-gatherer woman. The adjacent narrow grave contains the headless skeleton of a man with hardly any mortuary offerings (image courtesy of the author).

basketry impressions. The second layer includes a shouldered axe of a type found occasionally by Colani in Hoabinhian contexts, as well as incised and cord-marked pottery. The early parts of this assemblage have provided a radiocarbon date of ~6.5 kya. The final assemblage includes shouldered, polished axes, and adzes.

Da But, a 5-m-thick settlement in Thanh Hoa province, was located in the vicinity of an estuary near salt marshes. Patte (1932) recovered polished stone axes matching those of the inland hunter-gatherer sites together with 12 burials inhumed in a flexed position and associated with round-based pottery vessels, shell jewelry, stone axes, and red ochre. A radiocarbon determination of 4500–5000 BC comes from a layer 70 cm below the site's surface.

As the sea level fell away from Da But, settlement followed the receding shoreline. Con Co Ngua is slightly larger than Da But, and the biological remains indicate the same marine adaptation. However, occupation here continued after a change from marine to more inland conditions dated to ~3500 BC, at which point we find stone hoes in addition to the bones of the pig and water buffalo.

Bau Tro is a small site set among sand dunes, and one of many found on old raised beaches. Three lenses of shell midden interspersed with sand comprise a 3-m-deep sequence. The stone industry involved the manufacture and sharpening of polished stone adzes. Pottery is mainly decorated with cord-marked impressions, although some have incised decoration and lines of circular indentations. Stone rings and beads are encountered, as well as possibly the earliest evidence for interment of the dead in jars (Reinecke 1998). The evidence from Bau Tro indicates a marine adaptation by a people who probably occupied the area for three successive but fairly brief periods between 2500 and 2000 BC.

The Two-Layer Hypothesis, or, What Happened to the Hunter-Gatherers?

Whereas the isolated Andamanese hunter-gatherers have retained their own languages, the Semang and Aeta speak languages within the Austroasiatic (AA) or Austronesian families. Falling back into remote forests, the few surviving hunter-gatherers on the mainland are surrounded by dense populations that rely on agriculture and stock rearing. This contrast has stimulated much research and spawned explanatory models distilled into the so-called two-layer hypothesis, which identifies the expansion of agriculturally proficient groups into Southeast Asia who encountered widespread hunter-gatherer communities. Rice was the dominant cultivated crop, but millet was also introduced (Weber et al. 2010).

Archaeologically, the transitions from hunting and gathering to rice and millet cultivation have been pinpointed respectively in the broad reaches of the middle to lower Yangtze River and the Yellow River. Recent research in the former has identified a long process of selection, particularly for nonshattering rice, that extended over millennia before this plant took precedence over broad-spectrum collecting, fishing, and hunting (Fuller et al. 2010). Rice was a component of a broad-spectrum hunting and gathering economy during the first half of the sixth millennium BC, and some of it might have been cultivated. A millennium later at the lacustrine site of Tianluoshan, the successive layers, dating from 4900 to 4600

BC, reveal that rice was growing in numerical importance relative to other plant foods, such as acorns and water chestnuts, whereas the proportion of the rice falling into the domestic category rose from 27% to 39% (Nakamura 2010). There was a remarkably broad spectrum of collected plants, fish, and hunted animals at this site. It was only with the Liangzhu culture, dated from 3200 to 2300 BC, that rice became a dominant part of the economy, and population growth expanded markedly. Fuller et al. (2010) have followed the expansion outward of rice-farming communities, labeling each as a thrust. Thrust 5, they suggest, saw rice farmers moving south into Southeast Asia, probably taking place during the third millennium BC. Archaeologically, Rispoli (2007) and Zhang and Hung (2010) have followed this trail on the basis of similar traditions for decorating ceramic vessels, a distinctive method of interring the dead, the use of spindle whorls, and the presence of both rice and domestic pigs and dogs.

In Southeast Asia, fieldwork dedicated to tracing and examining this ingress is not straightforward. Many Neolithic settlement sites may well have been covered by a recent deposition of riverine sediments following deforestation, whereas others are deeply buried below Bronze or Iron Age remains. However, when encountered, they display a sharp contrast to hunter-gatherer sites in virtually all respects. This is best demonstrated at the site of Ban Non Wat in Northeast Thailand. The basal levels of this site are composed of shell middens that contain sherds in a ceramic style involving impressed, incised, and painted designs that are paralleled from Central Thailand and Cambodia to Vietnam and into southern China. The initial occupation had been dated to the seventeenth century BC. These early contexts also incorporate human burials. Those ascribed to the initial Neolithic settlers took two forms. Most adults were interred in an extended, supine position and were accompanied by complete ceramic vessels decorated with complex incised, impressed, and painted designs. Grave goods included domestic pig bones and cowrie shells. Two adults were found seated within large, lidded ceramic vessels. These Neolithic burials contrast with a second group of contemporary graves in which the dead were placed in a flexed position in the tradition of the indigenous hunter-gatherers (Higham and Kijngam 2011). The mortuary offerings with these individuals, while few, are in marked contrast to those associated with the Neolithic. The most likely interpretation of this assemblage is that the intrusive Neolithic rice farmers interacted and integrated with a group of indigenous hunter-gatherers. The obvious questions of whether the physical remains of the two groups differ, and if so, how, have not yet been answered.

However, at Man Bac in northern Vietnam, a second Neolithic cemetery and settlement have been opened. Again, we find extended, supine inhumation burials associated with ceramic vessels incised and impressed with complex motifs. The population biology has been assessed in several complementary studies. Visual inspection alone suggested that there are two groups of skulls: one with a narrow and flat face, and the other with a lower and wider face. To investigate these differences further, a series of measurements were taken and subjected to a statistical analysis in conjunction with samples of crania from other prehistoric sites, and with modern

people (Matsumura 2010a). Nine of the Man Bac males cluster in the results of the statistical analyses with the inhabitants of Neolithic Ban Chiang, the people of the later Iron Age, and modern Vietnamese. Most interestingly, the former group also clusters with the Neolithic inhabitants of the site of Weidun, an earlier agricultural community located in the Yangtze Valley. Five individuals, however, cluster with the earlier hunter-gatherers of this region.

The study of the cranium is not restricted to shape and measurements. There is also a series of nonmetrical features that are genetically determined and therefore an informative approach to population histories. Dodo (2010) has investigated six of these to identify similarities or differences with other sites and regions. The results place Man Bac closest to the Weidun people of the Yangtze basin, and furthest from a sample of Australian Aborigines. Dodo has concluded that the Man Bac crania reflect an intrusion from southern China ancestral to the modern Vietnamese.

Teeth are particularly durable, and their size and form at Man Bac have been considered relative to other samples, again with the added refinement of statistical analyses (Matsumura 2010b). On the basis of the crown diameter, the Man Bac people are closest to the modern Lao, and the prehistoric Chinese inhabitants of Weidun and Songze. They also differ markedly from the preceding hunter-gatherers from the sites of Con Co Ngua and Bac Son, as well as Andamanese and Australian Aborigines. As for the nonmetric variables, they too link this site with a movement of immigrant rice farmers from southern China, but not without some contribution from the indigenous hunter-gatherers. Finally, Shinoda (2010) has been able to sequence mitochondrial DNA from some of the burials. It is evident that the cemetery contained individuals from several maternal lineages. Moreover, the haplogroups identified at the site suggest that there was indeed a southward movement of immigrants, and a local admixture with the indigenous hunter-gatherers.

The importance of the Man Bac site lies in the consistent indication that the population incorporated immigrants from southern China who encountered and integrated with the long-established indigenous inhabitants. This harmonizes with the evidence from Ban Non Wat and Khok Phanom Di, as well as the indications from the DNA of modern inhabitants, of a significant contribution from hunter-gatherers.

This ingress of Neolithic rice farmers is now well documented archaeologically, and inasmuch as there is any evidence to be deduced from ancient DNA, it is further supported archaeogenetically not only from Man Bac but also from two Mun Valley sites, Noen U-Loke and Ban Lum Khao. Here, the mitochondrial DNA for the Bronze and Iron Age people (1000 BC–500 AD) is closest to that from modern Mon-speaking rice farmers (Lertrit et al. 2007). There are also few dissidents from the close relationship between the expansion of rice farmers and the wide distribution of AA languages, although, as Chaubey et al. (2011) have shown, the genetic links between speakers of the Munda branch of AA in India and Southeast Asian speakers may well have a time depth exceeding that of the spread of rice agriculture. While the actual homeland of proto-AA speakers still divides opinion and will probably never be settled, the cognates for rice and aspects of its cultivation, as well as taro and millet that are widely spread from Vietnam to India,

underwrite the conclusion that the early diaspora of AA speakers involved domestic crops and animals (Blench 2011; Diffloth 2011; Sagart 2011).

The Implications of the Two-Layer Hypothesis. Reid (2012; this issue) has traced the prehistory of the friction zone between intrusive farming groups and the indigenous hunter-gatherers through the aegis of linguistic change. He has identified the southward spread of farmers coming from Taiwan and, ultimately, mainland China along the course of the Cagayan Valley of Luzon, and the withdrawal of the hunter-gatherers, who adopted the farmers' Austronesian language, into forested upland refugia. This may well have been stimulated by the farmer practice of head collecting.

The situation on the mainland of Southeast Asia is better documented through archaeology, although linguistically the indigenous hunter-gatherers have adopted intrusive AA languages. The genetic data stress the continuing presence of significant indigenous hunter-gatherer haplogroups in the modern population (Hill et al. 2006). At the same time, haplogroup F1a1a, not to mention the inferences drawn from cranial and dental morphology, indicates intrusive settlement from the north. However, at Man Bac, Khok Phanom Di and Ban Non Wat, we can identify interaction between the incoming farmers and the long-established hunter-gatherers. The latter did not simply disappear; the two groups appear to have integrated one with the other.

During the period from the initial expansion of rice and millet farmers into Southeast Asia, we can trace first a period of Neolithic settlement from ~1700 to 1000 BC, followed by the Bronze Age (1000–500 BC) and the Iron Age (from the fifth century BC). In the lowlands river plains, rice cultivation was undertaken in conjunction with the rearing of domestic pigs and cattle, but fishing, hunting, and gathering contributed significantly to the diet, as they continue to do so to this day. The expansion of these early farming communities eventually reached peninsular Thailand and Malaysia, where the ceramic vessels from Jenderam Hilir are closely matched in Neolithic settlements in Central Thailand. Here, the incoming farmers would have encountered Hoabinhian hunter-gatherers. Doubtless, there was again some integration: Bellwood (1993) has long since suggested that this can be seen in the case of the Senoi. However, some hunter-gatherer groups, as in the Philippines, withdrew into the interior rainforests and maintained their long-established way of life. They continue to do so and are known as the Semang and the Mani. Over a period of four millennia, perhaps as many as 100 generations, natural selection may have favored small stature and dark skin color. They are significantly smaller than their Hoabinhian predecessors.

Similarly small stature and dark skin characterize the hunter-gatherers of the Andaman islands. Here again, there has been a pattern of extinction, integration, and survival in refugia because first British and then Indian administration have wrought their inevitable changes. The Sentinalese ferociously maintain their island independence, but their contemporaries on the large islands have not. But there is a common theme in all three instances in which small-bodied hunter-gatherers

are still to be found—resilience in the face of the inexorable expansion of lowland farmers, and both cultural and physical adaptations to the challenges thus posed.

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