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The Routledge Handbook of Bioarchaeology in Southeast Asia and the Pacific Islands

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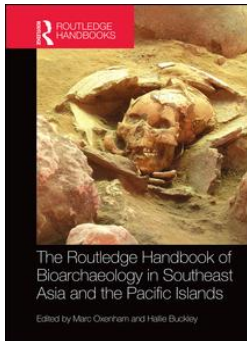
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Human cultural, technological and adaptive changes from the end of the Pleistocene to the mid-Holocene in Southeast Asia

Philip J. Piper

Introduction

The climatic amelioration at the end of the LGP had profound effects on landscapes and environments. In ISEA, the rising sea levels, as a consequence of polar ice melt, resulted in the drowning of a large proportion of the low-lying plains on the Sunda Shelf and separated Borneo, Sumatra and Java from each other and Peninsular Malaysia. Inundation of the rich and diverse coastal ecology that provided important hunting and foraging grounds for local hunter-gatherer populations was severely disrupted, causing their displacement. Some populations likely died out, others migrated inland or crossed the oceans to find more productive environments and establish new territories.

The profound environmental shifts during the terminal Pleistocene and Early Holocene were also coincident with one of the pivotal periods in human history in the region, one that included significant changes in technology, the intensification of plant processing and the emergence of burial traditions.

This chapter discusses climatic factors throughout the Late Pleistocene to mid-Holocene that contributed to the dramatic re-shaping of landscapes and environments across ISEA. It examines the likely effects marine transgression and landscape submergence had on resident hunter-gatherer populations and discusses some of the new technologies in stone, bone and shell that appear in Southeast Asia (SEA) during this period, as well as the translocation of plants, and the emergence and spread of a variety of burial traditions. It also investigates how the initial appearance and then geographic spread of these cultural and technological practices inform on contact and interaction between human populations from MSEA across maritime SEA as far as Melanesia.

Landscape transformations and environmental change through the Late Pleistocene and Early Holocene

Changing climates at the end of the Pleistocene had profound effects on landscape configurations and the environment across maritime SEA. Throughout this period, climatic shifts resulted in changes in sea level starting from an apparent low-stand of -125 ± 6 m at *c.*135 kya before the

onset of the Late Pleistocene, to a level higher than at present during the penultimate glaciation ($c.123\text{--}116\text{ kya}$; McCulloch & Essat, 2000; Rohling et al., 1998). This change in sea levels culminated in the insularization of much of the Sundaic biogeographic region. This period was also marked by changes in regional climate and environment from the open woodland and grasslands that characterized the Middle Pleistocene to one of closed tropical rainforests. As a consequence, a large proportion of native megafauna went extinct and was replaced by the modern tropical rainforest fauna characteristic of the region today (van den Bergh, de Vos & Sondaar, 2001; de Vos & Long, 2001). This period has also produced controversial evidence for the earliest arrival of AMH to the region (Storm et al., 2005).

At the end of the penultimate interglacial ($c.110\text{ kya}$) the climate cooled progressively through a series of pronounced stadials (cold phases at $c.116\text{--}110\text{ kya}$ and $c.100\text{--}87\text{ kya}$) interspersed with major inter-stadials (warm phases at $c.110\text{--}100\text{ kya}$ and $c.87\text{--}74\text{ kya}$) (Lambeck, Esat & Potter, 2002). During stadials, many of the islands within the Sundaic biogeographic region reformed into a single sub-continental landmass known as ‘Sundaland’, which extended from Peninsular Malaysia to the tip of Borneo in the north and Bali in the south (Molengraf & Weber, 1921), and covered $c.1.85$ million km^2 (Figure 3.1). Many of the Wallacean island groups coalesced into

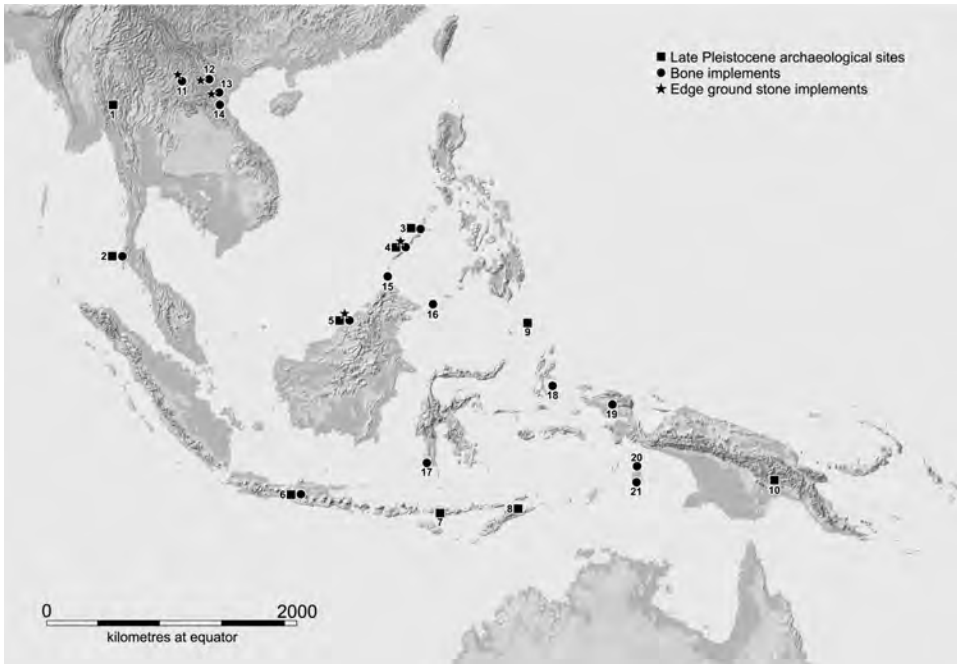


Figure 3.1 The geographic distribution of archaeological sites referred to in the text that produced evidence of human subsistence strategies (squares), bone implements (circles) and edge-ground stone technologies during the Late Pleistocene to mid-Holocene across Southeast Asia and Melanesia

Source: Background map prepared by Treehouse Maps, Arnhem, Netherlands; modified and details added by Brenton Hill, colorfst@gmail.com.

Notes: 1 Tham Lod; 2 Lang Longrien; 3 Ille; 4 Tabon and Sa'gung; 5 Niah; 6 Wajak, Song Gupuh, Song Terus, Song Keplek, Gua Braholo, Gua Kidul; 7 Liang Bua; 8 Jerimalai, Lene Hara, Matja Kuru 2; 9 Leang Sarru; 10 Kuk; 11 Mai Da Dieu; 12 Xom Trai; 13 Con Co Ngua; 14 Con Moong, Hang Boi, Hang Trong; 15 Gua Balambangan; 16 Balobok; 17 Ulu Leang I; 18 Golo; 19 Kria; 20 Liang Nabulei Lisa; 21 Liang Lemdubu.

larger islands (e.g. Philippines) but remained isolated from both Sundaland and Sahul (consisting of Australia, New Guinea and many smaller islands).

Tropical rainforest seems to have persisted throughout ISEA until *c.*82 kya, after which a drier and cooler climate is recorded in Java (van der Kaars & Dam 1995, 1997), and a savannah corridor likely was established through the central region of Sundaland from the Thai/Malay peninsula to Java, and remained until the onset of the Holocene (Bird, Taylor & Hunt, 2005). By *c.*45 kya, modern human populations were widely distributed across SEA and Australasia. There is skeletal evidence of a human presence at Niah Cave on Borneo from *c.*45 kya onwards (Reynolds et al., 2013), Tabon Cave on Palawan at *c.*40 kya (Détroit et al., 2004) and Wajak in East Java at *c.*35 kya (Storm et al., 2013). Between 30 and 28 kya temperatures started to rapidly fall and sea levels are estimated to have reached a lower limit of *c.*–123 m during the LGM (Hanebuth, Statterger, & Bojanowski, 2009). Extreme conditions were reached between 23 and 18 kya, when mean temperatures are estimated to have been 2–3.5°C below present (Gagan, Hendy, Haberle, & Hantoro, 2004; Rosenthal, Oppo, & Linsley, 2003; Visser, Thunell, & Stott, 2003). The archaeological evidence for a human presence in ISEA during this period is scarce with hiatuses in habitation noted at Song Terus (Sémah & Sémah, 2012) and Niah (Reynolds et al., 2013). It is likely that people abandoned these sites that would have been further away from the coasts during this cold phase, and moved out on to the low-lying plains, and closer to coastlines.

Between 14.6 and 14.3 kya, the global climate began to improve and sea levels rapidly rose at an average of 5.33 m per 100 years from –80 to –64 m, corresponding to Meltwater Pulse 1A (Hanebuth & Statterger, 2004). By the onset of the Holocene, Sumatra and Borneo remained connected to Peninsular Malaysia by a land bridge through the Karimata Strait. This was eventually severed at *c.*10 kya (Cranbrook, 2000; Voris, 2000). The oceans continued to rise from around –20 m at 9 kya to the mid-Holocene high sea stand at 7 kya when sea levels reached 2–5 m higher than at present. The mid-Holocene transgression caused the inundation of many low-lying areas and allowed the expansion of mangrove swamps in coastal areas (Allen, 1987; Berdin, Siringan, & Maeda, 2003; Woodroffe, Thom, & Chappell, 1985). On land, and driven by rising temperatures and changes in precipitation, the tropical rainforests expanded and the savanna corridor established between Peninsula Malaysia and Java contracted (Flenley, 1996).

Changing subsistence patterns, animal translocations and plant management and domestication

There is evidence from the Late Pleistocene of the human inhabitants of ISEA using a range of different hunting and foraging strategies to take advantage of the various local and regional resources available to them (Piper & Rabett, 2014). For example, at Song Gupuh (*c.*70 kya) and Song Terus (*c.*80 kya) in eastern Java, Tham Lod rock shelter (*c.*35 kya) in northern Thailand, Lang Rongrien (*c.*42 kya) in southern Thailand and at Ille Cave (*c.*13 kya) the focus seems to have been on large game such as suids, cervids and bovines (not Palawan) in open woodland/savanna (Figure 3.1; Morwood et al., 2008; Mudar & Anderson, 2007; Piper, Ochoa, Robles, Lewis, & Paz, 2011; Schoochondej, 2000; Sémah & Sémah, 2012). In the more forested environments around Niah, hunting strategies focused not only on pigs, but a relatively diverse range of prey including arboreal taxa such as orangutan (*Pongo pygmaeus*), macaques (*Macaca* spp.) and leaf monkeys (*Presbytis* spp.) and a variety of birds and aquatic and terrestrial vertebrates such as turtles (Geoemydidae and Trionychidae) (Rabett, Piper, & Barker, 2006; Rabett & Barker, 2007). On the isolated islands of Wallacea, where large mammals were absent, there is evidence for the exploitation of coastal resources at *c.*35 kya at Lene Hara and even some possible offshore fishing as early as *c.*42 kya at Jerimalai in Timor Leste (O'Connor, 2007; O'Connor,

Ono, & Clarkson, 2011). There is also evidence of coastal resource procurement at *c.*35 kya at Leang Sarru on Talaud Island, an isolated island between the southern Philippines and northern Sulawesi (Ono, Soegondho, & Yoneda, 2009).

The procurement of plants is also evident during the Late Pleistocene across the region. At Niah, plant processing includes sago palm (*Eugeissona utilis* and/or *Caryota mitis*), yams (*Dioscorea* spp.), aroids that contain an irritant, and *Pangium edule*, a mangrove-adapted tree whose fruits are inedible unless detoxified (Barton, 2005; Zuraina, 1982). Several pits potentially used in the detoxification process of aroids and *Pangium* were also recorded at Niah dating to *c.*34 kya (Reynolds et al., 2013). However, there is a lack of technological evidence for the intensive plant processing in the Late Pleistocene that would emerge during the early Holocene, and perhaps the potential of these resources had yet to be fully realized.

In the early Holocene, and as a result of rising sea levels inundating lowland coastal regions, many cave sites including Ille, Niah, Song Keplek, Gua Braholo and Song Gupuh come within the range of coastal foraging, as evidenced by the accumulation of large shell middens (Rabett et al., 2013; Lewis et al., 2008; Simanjuntak, 2002; Morwood et al., 2008). The archaeological record also indicates more intensive and prolonged occupation of these sites during this period. For example, at Niah from *c.*14 kya onwards, three cave entrances (West Mouth, Lobang Hagus, and Gan Kira) are frequented regularly and perhaps even contemporaneously (Barton et al., 2013) (see Lloyd-Smith et al., this volume). There is a much greater emphasis on the hunting of arboreal taxa, and in particular monkeys (Cercopithecidae), orangutan and civet cats (Viverridae) than in the Late Pleistocene (Piper & Rabett, 2009, 2014; Rabett, 2012). The environment around Niah had always been suitable for arboreal taxa and it is possible that one reason for the substantially higher numbers of monkeys and other small game during this period was improvements in range technologies, specifically the bow and arrow (Rabett & Piper, 2012, see below). A similar shift in hunting strategy in association with closure of tropical rainforests is observed at Song Gupuh, Song Terus, Song Keplek and Gua Braholo (Simanjuntak, 2002; Morwood et al., 2008; Sémah & Sémah, 2012).

Another feature of animal bone assemblages from the terminal Pleistocene onwards at Niah is the paucity of pig mandibles and monkey skulls. There appears to be no taphonomic reason for the selective 'disappearance' of these specific elements, and this raises the possibility that the inhabitants of Niah selectively retained these skulls and mandibles as trophies or for some other social/ritual purpose. The bones of predatory birds and hornbills are also a regular feature of bone assemblages at Niah, and it is plausible that these large birds were selectively targeted for their colorful plumage and bills, and perhaps for what they might have represented ritually and/or symbolically (Piper & Rabett, 2014). Both the collection of hunting trophies and the use of bird plumage is a common feature of many contemporary indigenous groups across ISEA and Melanesia (Bennett, Nyaoi, & Sompud, 1997). Another example of the selective use of monkey crania and other articulated (and sometimes burnt) skeletal elements in the mid-Holocene is in association with human burials at Song Terus and Song Keplek 5, Java (Détroit, 2006).

The intensive use of pounders, pestles and mortars for plant processing and grinding resins and minerals such as haematite also emerges at several sites across ISEA, MSEA and on New Guinea in the early Holocene (Bellwood, 1997: 181; Barker et al., 2013: 354–356; Simanjuntak, 2002), and at Liang Bua on Flores by 11 kya (Morwood et al., 2008). However, none of the highly decorative pestles and mortars reported by Swadling and Hide (2005) potentially dating from 8 kya onwards in New Guinea has been found in ISEA.

Several globally significant food plants probably owe their origins to management intensification in ISEA and/or New Guinea during the Early to mid-Holocene (Denham, 2013). For instance, early agriculture based on vegetative propagation in New Guinea includes taro and

some yams at *c.*7–6.4 kya (Fuller et al., 2014). Archaeological evidence dated between 6.9 and 6.4 kya suggests the cultivation of bananas was already taking place at Kuk Swamp in the New Guinea Highlands (Denham et al. 2003; Denham, Haberle, & Lentfer, 2004).

At Niah, the analysis of macro- and microbotanical remains indicates the gathering of nuts of *Pangium edule*, *Elaeocarpus* and *Canarium*, tubers such as taro (*Colocasia cf. esculenta*) and the seeds of grasses and sedges that would have been used for the production of textiles as well as a food resource. Early Holocene levels at Ille Cave include frequent remains of *Canarium*, parenchyma of wild yam (*Dioscorea hispida*), morphologically domesticated yam (*Dioscorea alata*) and taro (*Colocasia cf. esculata*) as well as the seeds of *Boehmeria cf. platanifolia* and *B. racemosa*, fibrous shrubs useful for making string (Barker et al., 2011). Alongside the intensification of plant use there is a significant increase in forest disturbance, probably associated with the vegetative reproduction of tuberous plants as a system of forest management and resource enhancement across ISEA and Melanesia (Denham et al., 2003; Barker et al., 2013: 355).

Implements manufactured of bone, stone and shell

Certain aspects of material culture have their roots within the Late Pleistocene but appear to increase in geographic distribution and abundance during the terminal Pleistocene and into the Early Holocene, and use contexts potentially change.

Osseous technologies are a good case in point. Some of the earliest bone artifacts in Southeast Asia have been identified in the West Mouth of Niah Cave dating to *c.*45 kya (Figure 3.1; Rabett, 2005; Rabett & Piper, 2012). The Niah sample of this period consists of 13 pieces, including pig tusk tools and a pigmented hard-shell turtle (Geoemydidae) plastron. There are also several point forms but no evidence of their use as projectile armatures (Rabett et al., 2006; Rabett & Piper, 2012; Reynolds et al., 2013). At Lang Longrien in Peninsular Thailand a single piece of bone dated to *c.*42 kya demonstrates the groove and snap technique (Anderson, 1990, 1997). Two potentially early bone artifacts from the ‘Tabuhan’ layers (*c.*30–80 kya) of Song Terus in East Java are illustrated by Kusno (2009), and a remarkably complex bone artifact, discovered recently at Matja Kuru 2 in East Timor, is interpreted as the base of a projectile point that was hafted, and is dated to *c.*34 kya (O’Connor, Robertson, & Aplin, 2014).

From the terminal Pleistocene onwards, there is a notable increase in the manufacture and use of osseous implements. They appear to have been produced on a variety of raw materials to fulfill a range of technological functions including cutting, shaping, perforating, possibly digging and fabrication, and as hafted projectile points (Rabett, 2005; Rabett & Piper 2012). At Niah between $10,534 \pm 131$ cal BCE (OxA-13936) and $10,423 \pm 95$ cal BCE (OxA-13939), the local foraging populations started manufacturing bone points for piercing, pig tusk tools for scraping and grinding, and hafted composite projectile armatures (Barton et al., 2013). The appearance of this latter technology coincides with the shift to greater hunting emphasis of primates, the limb bones of which were then used to produce more osseous implements (Piper & Rabett, 2009). Several hafted stingray spines, a technology observed nowhere else in ISEA this early, were recovered from deposits dating between $8,936 \pm 148$ cal BCE (OxA-12391) and $6,863 \pm 109$ cal BCE (OxA-18358) (Barton, Piper, Rabett, & Reeds, 2009). Also in Borneo, bone implements appear for the first time at the coastal site of Gua Balambangan, on Pulau off the northeast coast of Sabah between $9,503 \pm 319$ cal BCE (Beta-109141) and $8,057 \pm 227$ cal BCE (Beta-109140), some 8,000 years after the site was first occupied (Rabett & Piper, 2012; Zuraina, Ignatius, Tjia, & Koon, 1998). The implements appear to have been designed for an extractive strategy that focused on coastal margin environments (Rabett, 2005).

On Java, bone implements found at Gua Braholo date from as early as $11,923 \pm 181$ cal BCE (no lab code) (Simanjunak & Asikin, 2004). Excavations at Song Gupuh produced edge and point pieces dating from *c.*11 kya onwards (Morwood et al., 2008), and a relatively large collection of points, ‘spatulas’, ‘pins’ and a small adze were recorded at Song Terus dating between 8 and 9 kya (Sémah et al., 2004). At both these sites, an increase in bone technologies appears to coincide with a shift to the hunting of a wider diversity of game, with a higher proportion of arboreal taxa. Dates obtained by Simanjunak and Asikin (2004) for Song Keplek and Gunung Kidul suggest the initial appearance of bone technology by $8,002 \pm 299$ cal BCE (no lab code).

On the mainland, the earliest bone technologies have been recorded in northern Vietnam at Xom Trai, between $17,309 \pm 114$ cal BCE (Bln-3042) and $20,062 \pm 211$ cal BCE (Bln-3472), and at Con Moong cave in the Hoabinhian unit (Culture Layer II), dating to between $10,186 \pm 132$ cal BCE (Bln-3485) and $9,401 \pm 229$ cal BCE (ZK-340) (Nguyen Viet, 2000). Another *c.*250 bone artifacts have been recovered from some 150 Hoabinhian sites in northern Vietnam dating broadly to the Pleistocene–Holocene transition (Rabett & Piper, 2012). In Ninh Binh province, a small number of bone implements were identified at Hang Boi dating to *c.*13 kya and Hang Trong, where they are likely to be of Early Holocene age (Rabett, 2012). In the mid-Holocene, bone artifacts have been recovered from Da But sites in northern Vietnam, a cultural complex that took shape along the coastal lowlands of the Gulf of Tonkin around *c.*8 kya (Nguyen Viet, 2005).

Small numbers of osseous implements have also been recorded at Moh Khiew in the Thai/Malay peninsula dating from $10,943 \pm 128$ cal BCE (OAEP-1284) and at the neighbouring site of Sakai in Early Holocene deposits (Rabett, 2002; Rabett & Piper, 2012).

In southern Sulawesi, bone implements, considered typical of those attributed to the ‘Toalean’ culture, have been recovered from Ulu Leang 1 rock-shelter with an earliest date of $6,069 \pm 660$ cal BCE (ANU-606) (Olsen & Glover, 2004). At other sites across the same peninsula, south of the Cenrana Valley, bone points are added to the Toalean repertoire between 7 and 8 kya.

In the Philippines, the earliest record of a bone implement in the form of a fishing gorge comes from the site of Bubog I on Ilin Island dating to before 9,150–8,810 cal BCE (WK-32983; Pawlik et al., 2014). Ille on Palawan has produced a total of three bone artifacts with an associated date of $c.$ 4,615 \pm 57 cal BCE (OxA-16095) (Lewis et al., 2008; Ochoa, 2009), and Balobok rock-shelter on Tawi Tawi in the Sulu Sea has also produced bone artifacts, possibly dating to the Early or mid-Holocene (Ronquillo, Santiago, Asato & Tanaka, 1993; Bautista, 2001), but problems exist with the marine dating of shell and stratigraphy for this site (Spriggs, 2003).

Bone technologies have also been reported from several islands in Wallacea and from the northern edge of the Sahul Shelf at this time. There is a probable early occurrence of bone technology at Liang Lemdubu on Aru Island dated to $17,770 \pm 530$ cal BCE (OZD-460), and later in the archaeological sequence at $8,674 \pm 65$ cal BCE (OZF-356). At Liang Nabulei Lisa, bone projectile points and perforators were excavated from contexts dated to between $9,314 \pm 68$ cal BCE (OZD-699) and $5,850 \pm 151$ cal BCE (ANU-10905) (Pasveer, 2006). Pasveer and Bellwood (2004) have reported a total of 78 bone artifacts from the upper pre-ceramic phase at Golo Cave, Gebe Island in the North Maluku islands, dating to between 6,015–5,793 cal BCE (ANU-9449) and 1,741–1,294 cal BCE (ANU-9448) (CALIB 5.0.1) (Figures 3.1 and 3.2; Szabó, Brumm & Bellwood, 2007). At Kria Cave on the Bird’s Head Peninsula, Papua New Guinea, bone artifacts used primarily as perforators were dated to a comparatively brief interval from 5,730–5,560 cal BCE (GrA-9103) to 3,260–2,890 cal BCE (GrA-9100) (Pasveer, 2004).

Hafted edge-ground stone axes/adzes are known from Arnheim Land, the Kimberley and on Cape York in northern Australia, and in Papua New Guinea, where the grinding of stone tools and adzes associated with ‘waisting’ for the attachment of a haft can be traced back to the Late Pleistocene (Anderson & Summerhayes, 2008; Geneste, David, Plisson, Delannoy & Petchey, 2012). In Japan,



Figure 3.2 A selection of early Holocene bone implement types from Golo Cave, Gebe Island, Moluccas

Source: Illustration by the author.

edge-ground flaked and pebble tools occur throughout the archaeological record before *c.*30 kya, and perhaps as early as *c.*38 kya (Tsutsumi, 2012). In SEA, the earliest records of edge-ground adzes or axes (sometimes known as proto-Neoliths) have been recorded from the Hoabinhian sites of Xom Trai and Mai Da Dieu in northern Vietnam, where this technique of preparation dates to *c.*16 kya (Figures 3.1 & 3.3; Rabett, 2012: 186) or a little later. But the proliferation of this technological tradition in Vietnam is considered to have occurred after *c.*11 kya, in association with the Bacsonian Culture (Bellwood, 1997: 161–162). It is then found throughout Thailand and Malaysia as well during the mid-Holocene (Bellwood, 1997; Geneste et al., 2012). Edge and fully ground adzes are also a characteristic of the Da But Culture, where they appear after *c.*7 kya (Nguyen Viet, 2005).

Edge-ground technologies are relatively rare in ISEA, but two flakes produced during the rejuvenation or maintenance of tools with ground edges were recovered in the West Mouth of Niah Cave immediately below a date of 6,695–7,031 cal BCE (OxA-18358) and above an horizon dated to 8,751–9,186 cal BCE (OxA-12391) (Rabett et al., 2013: 227). Kress (2004) reported the occurrence of edge-ground adzes in association with two tightly flexed burials from Sa'gung Rock Shelter in central Palawan. Though undated, these burials were aceramic, and reminiscent of those from Borneo and northern Vietnam dating to the mid-Holocene.

Shell adzes appear in the terminal Pleistocene or early Holocene from the Philippines to Melanesia (Figure 3.4). They were produced using a single fold section of the body (mostly Melanesia) and/or hinge (mostly Philippines) of the giant clam (*Hippopus* or *Tridacna*) or the thickened aperture of the horned helmet *Cassia cornuta*. During the early to mid-Holocene, these implements were mostly unmodified with the exception of light grinding or abrasion to the bevel and/or edges (Szabó, 2004). Notwithstanding problems with dating (see Pawlik et al., 2015), probably some of the earliest edge-ground shell adzes are from the Mollucas or Melanesia. For example, Golo Cave on Gebe Island produced several shell adzes associated with



Figure 3.3 Edge-ground stone adzes dating to the early Holocene from Xom Trai Cave, northern Vietnam

Source: Original images Nguyen Viet; illustration by the author.

radiocarbon dates on charcoal and shell of between $c.13$ kya and 8 kya (Bellwood et al., 1998). Similar *Tridacna* shell adzes of comparable age and form have been recorded at Pamwak on Manus, in the Admiralty Islands possibly dating to between 10 and 7 kya (Spriggs, 1991). A large *Tridacna* adze was recovered from the Sepik region, New Guinea, which produced a direct date of $3,030 \pm 90$ BCE (no code; Swadling & Hide, 2005: 291). O'Connor (2006: 81) reported an unstratified *Tridacna* adze from near the township of Tutuala in East Timor that returned a direct C^{14} date of 7,894–6,612 cal BCE (ANU 12061). This specimen differs from those reported elsewhere in that it is fully ground and shaped similar to the quadrangular stone adzes that become common after 3,550 cal BCE in maritime SEA (Bellwood, 1997: 155), and the artifact might have been produced using old shell (see O'Connor, 2006: 81).

Of three shell adzes reported by Tanudirjo (2001), the two oldest were edge-ground, manufactured from *Tridacna* and identified in aceramic layers at Leang Tahuna on Merampit Island, southeast of Halmahera and Leang Manaf on Sanana. They produced direct dates on the shell of 2,534–2,417 cal BP (OZD-771) and 5,483–5,324 cal BCE (OZD-772) respectively. A third shell adze/chisel from Waylia on Talaud Island was found on the ground surface. This was constructed from the thickened lip of a *Cassia cornuta* shell. This type of adze manufacture might have been a later innovation than those produced on giant clam, as reported from Wetef and Golo caves (Bellwood et al., 1998).

Shell adzes are also frequently found in early to mid-Holocene contexts in the Philippines, but problems of chronological accuracy and provenance often exist. For example, a single human burial at Duyong Cave produced three *Tridacna gigas* shell adzes and a 'gouge' neatly aligned down either side of the individual (Fox, 1970: 63 Fig.19a and b; Szabó, 2004: 283). A date of 3,965–2,693 cal BCE (UCLA-287) produced on charcoal 'found in the grave fill' (Fox, 1970: 60) should be treated

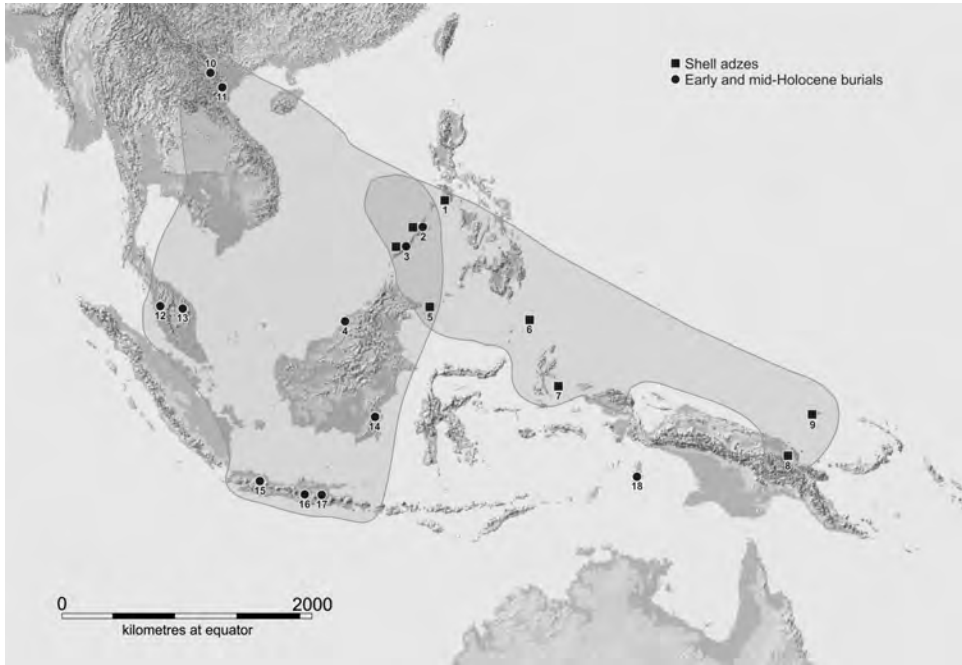


Figure 3.4 The geographic distribution of archaeological sites referred to in the text that produced shell adzes and human burials from the terminal Pleistocene to mid-Holocene in Southeast Asia and Melanesia

Source: Background map prepared by Treehouse Maps, Arnhem, Netherlands; modified and details added by Brenton Hill, colorfst@gmail.com, after Pawlik et al., in review).

Notes: 1 Bubog I; 2 Ille, Paredes; 3 Tabon, Duyong, Sa'gung, Batu Puti; 4 Niah; 5 Balobok, Sanga Sanga; 6 Leang Tahuna, Leang Manaf; 7 Golo, Buwawansi; 8 Sepik; 9 Pamwak; 10 Hang Cho; 11 Da But, Con Co Ngua; 12 Gua Teluk Ke-lewan; 13 Gua Cha, Gua Peraling; 14 Gua Tenngorak; 15 Pawon; 16 Punung III, Song Terus, Song Keplek, Gua Braholo; 17 Wajak, Hoekgrot; 18 Liang Lemdubu.

with caution. But the burial context was aceramic, suggesting that it is older than *c.*4.5kya, after which pottery first appears in the archaeological record of the Philippines. Two shell adzes identical to those found at Duyong were recovered from shallow disturbed deposits, apparently along with ground stone adzes, in Bato Puti on Lipuun Point, Palawan. Fox (1970: 62) associated these with the 'Neolithic' burials identified in the cave, though no definite stratigraphic or chronological correlation was evident. In 1965, Fox (1970: 64) recovered a *Tridacna* 'tool' from a grave in Paredes Rock Shelter on Langen Island, El Nido associated with two fully flexed inhumations and one supine burial. Shell adzes from Balobok on Tawi Tawi Island, southern Philippines have been argued to be as much as 7.5kya (Spoehr, 1973; Ronquillo et al., 1993), but the validity of the dates and the stratigraphic and chronological integrity of the shell adzes have been questioned (Spriggs, 1989). Solheim, Legaspi and Neri (1979) recorded shell adzes on Sanga Sanga Island in the Sulu Sea in pre-ceramic layers with radiocarbon dates on marine shell of $4,700 \pm 180$ and $5,995 \pm 90$ BCE. A much more securely dated shell adze has been recovered from Bubog I Rock Shelter on Ilin Island off the southwest coast of Mindoro. A direct AMS date on the adze returned an age of 5,600–5,300 cal BCE (S-ANU-35132). The security of this date is enhanced by the known recovery location of the artifact within a well-dated and stratigraphically secure context that brackets its manufacture between *c.*11 kya and *c.*6 kya (Figure 3.5; Pawlik et al., 2015).



Figure 3.5 Edge-ground shell adze directly dated to 5,550–5,250 cal BCE (S-ANU-35132) from Bubog I rock shelter on Ilin Island, Mindoro (after Pawlik et al., in review)

The emergence of burial traditions across Southeast Asia

The fossil remains of AMH prior to *c.*10kya are rare in ISEA (see Oxenham and Buckley, this volume) and there is currently no evidence of intentional interment of the dead prior to the terminal Pleistocene across the region. The earliest clear indication of deliberate burial in the region is from Liang Lemdubu on the Aru Islands. The disarticulated nature of the skeletal remains on excavation implied secondary burial of the corpse, perhaps in bundles, following soft-tissue decomposition. Estimated to date between *c.*18kya and 16kya, cut marks on the right humerus and ulna might suggest disarticulation after death. The body then appears to have been left to decay before being wrapped and buried in a seated position (Bulbeck, 2006). This is currently the only burial of this age identified east of Wallace's Line (except Australia) and geographically disassociated with the proliferation of burial tradition in ISEA. Nevertheless there are ways in which the body was treated after death that have parallels in the West Mouth of Niah, and at Gua Braholo and Ille Cave.

Within the West Mouth of Niah (see Lloyd-Smith et al., this volume) the oldest burials date between radiocarbon assays on two different individuals of 9,320–9,748 cal BCE (OxA-15157) and 6,404–7,504 cal BCE (OxA-16161). Treatment of the dead was highly variable and included flexed and seated inhumations, secondary un-burnt and cremation burial and flexed decapitated burials. One complex burial rite appears to have involved seating the deceased on a lit fire (Rabett et al., 2013). In addition, burials were not randomly distributed but rather spatially segregated, perhaps emphasizing different familial or group allegiances (Lloyd-Smith, 2012). The use of animal body parts in burial practice was also evident, in particular, with the use of a rhinoceros radius as a 'pillow' in a flexed burial (Figure 3.6; Cranbrook, 1986; Rabett et al., 2013). Likely early to mid-Holocene flexed burials in Borneo have also been recorded within the occupation deposits at Gua Tenkgorak (Widianto & Handini, 2003) and Kimanis (Arifin, 2004) in Kalimantan.

At Gua Braholo a secondary burial was found within a pit, which had charcoal and ash at the base, very similar to the seated burials at Niah. A C¹⁴ determination on the charcoal produced a date of 6,810 ± 170 BCE (Détroit, 2006: 196). This secondary burial was broadly contemporaneous with a tightly flexed burial found at the same level. Other tightly flexed and extended burials in Java have been recovered from Song Keplek (SK5) dating to 5,070 ± 180 BCE and SK4 at 2,560 ± 90 BCE, Song Terus 1 at 7,380 ± 90 BCE and Pawon 4 at 7,575 ± 200 BCE (Détroit, 2006:



Figure 3.6 Burial No. 27 from the West Mouth of Niah Caves, showing a flexed inhumation with a rhinoceros radius utilized as a ‘pillow’

Source: Reproduced with the permission of the Sarawak Museum; after Rabett et al., 2013).

199; Noerwildi, 2011/2012; Simanjuntak, 2002). At Hoekgrot in East Java, Eugene Dubois recovered the remains of at least three adults and one juvenile that had almost certainly been laid on the surface, or buried in the cave. One skeleton had been completely coated red, presumably with ochre (Storm, 1995). Although undated, there is a strong possibility that these human remains are also of early to mid-Holocene date.

At Ille on Palawan (see Lara et al., this volume), several cremation burials have been identified dating to the Early Holocene (Lewis et al., 2008). To date, the best studied of these is Burial 758 with direct dates of 7,310–7,056 cal BCE (OxA-16020) and 7,475–7,330 cal BCE (OxA-15982). Numerous, multiple cut marks concentrated at the joints and scrape marks on the surfaces of long bones and the cranium suggest that the body had been systematically defleshed, dismembered and long bones smashed before being placed in a container and buried (Lara, Paz, Lewis, & Solheim, 2013). The dismemberment and breakage might indicate that ritual cannibalism played a role in the burial rites.

Probably the oldest burials in the mainland have been recovered from Tam Hang Cave in northern Laos dating to *c.*14,000 cal BCE (Shackleford & Demeter, 2012). Other early dated flexed and crouched inhumations have been recorded at Pha Phen in Laos (*c.*5,000 cal BCE), Tham Lod (*c.*10,000–11,000 cal BCE), Ban Rai (*c.*8,000 cal BCE), Ban Tha Si in Thailand and Mai Da Nuoc (8,000–6,000 cal BCE) in northern Vietnam (Tayles et al., 2015). A flexed burial from Hang Cho Cave in northern Vietnam directly dated to 9,259 ± 260 BCE or 9,150–7,750 cal BCE (no code) was found in association with a variety of stone artifacts including plant-processing implements (Matsumura et al., 2006; Yoneda, 2006).

Primary flexed and secondary burials have been found in caves on the Malay Peninsula such as Gua Cha, Gua Teluk Ke-lewar and Gua Peraling (Zuraina, 2005). At Gua Cha, two types of single and multiple burials were recorded in the Hoabinhian phase of occupation, flexed and extended (Sieveking, 1954). Two secondary burials (B.15 and B.16) are of particular note: in these the bones had been “artificially broken and in some cases split to remove the marrow,”

reminiscent of Ille Cave. B.16, which was associated with a localized pile of ash and many of the bones had been burnt. Sieveking (1954: 93) interpreted this as possible cannibalism, but lacking ritual significance “since little care was taken in burial of these remains.”

In total more than 300 hundred burials have been recorded at Da But and Con Co Ngua in Thanh Hoa Province, Vietnam. At Da But, several burials dating to *c.*4,000 cal BCE were commonly interred in a seated position (Nguyen Viet, 2005), and at Con Co Ngua, dating to 3,500 cal BCE, tightly flexed burial was a common practice (Matsumura, Oxenham, Nguyen, Nguyen, & Nguyen, 2011).

Discussion of technological and behavioral change in the Early Holocene of Southeast Asia

If the single record of a maxillary premolar from Punung III in Java is accepted as representing an AMH, then there is the possibility that our species has inhabited ISEA throughout the last *c.*125 kya. There are further equivocal records of a human presence at Song Terus (Sémah & Sémah, 2012) and Song Gupuh (Morwood et al., 2008) from *c.*70 kya and *c.*80 kya respectively, but no human remains have been recovered to determine whether the archaeological records were accumulated by AMH or the pre-existing *Homo erectus* populations that are known to have been present in the region since *c.*1.7 million years ago (Sémah, Saleki, Falguères, Féraud, & Djubiantono, 2000).

By at least *c.*45 kya, there is archaeological evidence from across Australasia and SEA for a broad geographic presence of AMH. They had the technological capabilities to construct some sort of water craft that permitted them to traverse open sea and establish populations on various islands throughout Wallacea, and reach the continent of Australia. Intermittent frequentation of archaeological sites on small islands that probably did not possess the resources to maintain a permanent human population, such as small islands within the Talaud group, indicates that they probably had the seafaring means by which to make multiple, short return journeys.

These Pleistocene foragers also had a wide distribution across the expanses of the exposed Sunda shelf that conjoined the islands of ISEA with each other, and Peninsular Malaysia to form the sub-continental landmass of Sundaland. These early populations were accomplished foragers with the skills that enabled them to successfully colonize a diversity of habitats that included hunting large terrestrial game in the savanna and open woodlands that extended from the Thai/Malay peninsula south as far as Java and Bali, and capture a range of terrestrial and arboreal taxa in the tropical rainforests of northwest Borneo. They had also acquired the necessary expertise to process toxic plants to make them edible, and there is some environmental evidence indicating the early stages of forest management to enhance the growth of economically important plants and provide resources to attract potential game animals (Reynolds et al., 2013). These forager groups of SEA generally produced flaked stone implements and core tools. There is no evidence for the production and use of technologies specifically designed for the processing of plants. Osseous implements were already in existence at a few locales such as Niah and Lang Longrien, but individual artifacts are scarce, and use contexts were limited. Projectile technologies are absent.

During the coldest phases of the LGM, evidence for a human presence across SEA is scarce and most cave and rock shelter sites such as Niah, Song Gupuh, and Song Terus appear to have been seldom occupied, or completely abandoned during this period. The likelihood is that these sites became less than ideal locations for habitation, being long distances from the glacial coastlines.

From *c.*14 kya onwards, the climate began to warm and the polar ice caps melt. The rapidity of the marine advance at the end of the Pleistocene likely disrupted coastal ecology, made

remaining along coastlines less productive and reduced potential foraging ranges, perhaps bringing human populations into ever-closer contact with each other in pursuit of diminishing resources. It has been argued that the considerable changes in the geography of SEA was the catalyst for large-scale population movements, synchronous with the end of the last ice age at $c.12$ kya. This was followed by a subsequent population expansion, perhaps originating from Borneo and adjacent Wallacean islands (Sulawesi) and spreading across maritime SEA (Soares et al., 2008).

Some foragers certainly appear to have migrated inland where we observe renewed and sustained occupation of cave sites such as Song Terus, Song Keplek and Niah during the terminal Pleistocene and early Holocene, and the initial occupation of sites such as Ille Cave on Palawan. The archaeological record suggests these cave and rock shelter sites were more intensively utilized than previously, with the accumulation of large middens consisting of estuarine, mangrove and marine shell, indicating proximity to coastlines. Local mobility appears to have reduced with longer durations of occupation at single sites, perhaps as a result of a significant realignment of subsistence strategies, in part related to the climatic amelioration and expansion of the tropical rainforests, and perhaps in part as a result of technological advances and/or innovations in projectile technologies (Rabett & Piper, 2012). Whereas large terrestrial game adapted to open woodland and savanna environments was the hunting focus during the Late Pleistocene, the capture of arboreal prey such as monkeys and civet cats increased significantly, and prey diversity expanded, in the early Holocene.

The retention and/or use of pig mandibles and monkey skulls at Niah imply an increasing emphasis on the social importance of visual signaling within, and conceivably, between communities. Perhaps the display of hunting trophies was to stress an individual's prowess and/or to demarcate territorial boundaries, as has been recorded historically in Borneo (Medway, 1973). The use of feathers, beaks and other body parts of hornbills and predatory birds suggests the growing use of self-adornment and increasing ritual practices, as does the production of hematite and its use within burial contexts and perhaps as body paint and rock art. The inclusion of animal crania and other body parts in burials in Java and Borneo also implies a significant change in human perceptions of the environment, relationships with animal communities surrounding them, and ritual and ideological behavior (Figure 3.7). There is also an increasing emphasis on social identity evident in the use of animal body parts and hematite for ornamentation and decoration.

In the early Holocene, there is also a marked increase in the utilization of economic plants across SEA that coincides with the appearance of a variety of new technologies specifically designed for processing a variety of vegetative foodstuffs. The importance of New Guinea in regional developments emerges during this period. For example, some of the earliest evidence for aborigiculture/vegiculture and the translocation of tuberous plants such as yams and taros have been recorded at Kuk Swamp by $c.7$ – 8 kya (Denham et al., 2003). It is possible that these plants and the knowledge of how to manage them was transferred between populations across the region, perhaps as far as Palawan where morphologically domestic yam (*Dioscorea alata*) and taro (*Colocasia* cf. *esculata*) have been recorded at Ille during the early to mid-Holocene (Barker et al., 2011). Another example is edible diploid bananas derived from *Musa acuminata banksii*, a native of New Guinea that was hybridized with other wild species of ISEA bananas, including *Musa acuminata errans*, a native of the Philippines (Kennedy, 2008).

Shell adze technology also likely originated in Melanesia or northeastern Indonesia with the earliest records so far at Pamwak in the Admiralty Islands and Golo Cave on Gebe Island in the Moluccas (Szabó, 2004; Pawlik et al., 2015). By the early to mid-Holocene, shell adzes were in use from the islands north of New Guinea across the southern regions of the Philippine



Figure 3.7 An early Holocene flexed inhumation from Song Terus, Java, associated with a complete Javan lutung (*Trachypitecus auratus*) skull (circled)

Source: Reproduced with the kind permission of Francois Sémah, Florent Déroit and Truman Simanjuntak.

archipelago. Although there is some difference in the way the majority of shell adzes were produced in the Philippines, compared to those in Melanesia, Szabó (2004: 343) considered the manufacture of *Tridacna* and *Hippopus* adzes spanning northern maritime SEA to Near Oceania as a single tradition, linking these regions. Unlike stone adzes that were predominantly used for ‘agricultural’ purposes, Golson (2005) has argued that the shell adze was specifically designed for use in the construction of maritime technologies, and this would fit neatly with evidence for expanding maritime networks.

Another region of technological and cultural innovation might have been the northwestern fringes of the Sunda shelf and Wallacea, as proposed by Soares et al. (2008) and Bulbeck (2008). For example, by the terminal Pleistocene at Niah there is a considerable increase in the use of bone as a manufacturing medium. A variety of tools were produced for piercing, scraping and grinding and there is the first definitive evidence for the manufacture of hafted projectile technologies. In contrast, at Gua Balambangan the bone implements produced by the end of the Pleistocene were potentially utilized for the exploitation of mangroves. Further to the east at Golo in the Moluccas and Kria in the Bird’s Head, projectile points are absent and awls and ‘spatula-types’ are common. So, although the knowledge of osseous implement manufacture was transferred between forager communities across the region, each utilized it differently, producing a range of tool types contingent on local functional requirements (Rabett & Piper, 2012). By the early to mid-Holocene, implements in animal bone and tooth had become an integral part of hunter-gatherer repertoires, recorded at numerous sites from Vietnam and Thailand in the north to Java in the south and the Bird’s Head Peninsula of New Guinea in the east.

The earliest known burial in maritime SEA is recorded at Liang Lemdubu, on the fringes of the Sahul shelf, where a young woman was interred at c.18 kya. With reference to the geographic distribution of burials across SEA (Figure 3.4) this individual appears isolated, and

perhaps distinctive from the complex burial traditions emerging in MSEA and ISEA. In ISEA itself, the appearance of burials at Niah Cave from *c.*10kya onwards signifies a change in the perception of the living, the dead and perhaps perceptions of an after-life (Lloyd-Smith, 2012). The most common and widely distributed burial tradition appears to be tightly flexed interments, perhaps emerging first in northern Borneo and then spreading across maritime SEA as far as Java in the early Holocene, and northwest to Peninsular Malaysia by the mid-Holocene. Fire was also widely used in the early Holocene and has been identified in cremation burials at Niah, Ille Cave on Palawan and at Gua Braholo in Java. Other types of burial are more geographically restricted and might indicate closer community relationships across the region. For example, full cremation appears to be restricted to coastal sites along the eastern seaboard of the Sunda Shelf (Ille Cave, Palawan and Niah Cave, Borneo). The varying geographic distributions in how people treated the dead through complex burial rites suggests that different inter-connected forager groups fairly rapidly developed their own unique identities and ways of perceiving the world.

It has been proposed that the geographic distribution of seated burials in northern Borneo and Vietnam might indicate contact between the mainland and ISEA across the South China Sea during the mid-Holocene (Lloyd-Smith, 2012). However, Da But has much closer affiliations to the north, with the shell midden and burial sites containing mutilated flexed and seated burials associated with the late foragers/early farmers of the Ding Si Shan in Guangxi dating to *c.*8–7kya (Li et al., 2013). Both the Ding Si Shan and Da But sites have produced cord-marked pottery and fully ground stone adzes not found in Borneo or anywhere else in ISEA at this time. Based on the distribution of edge-ground stone adzes identified at Niah, and also Sa'gung Cave in southern Palawan as well as the Dabutian sites in Vietnam, there might have been some contact across the South China Sea during the earlier stages of the mid-Holocene (see Bulbeck, 2008).

Détroit (2006: 198–199) has argued that the early to mid-Holocene inhumations recorded in Java demonstrate a high degree of variability in methods of burial, and that the individuals interred exhibit considerable biological variability. This implies perhaps more than one population is represented, and it is likely that communities possessed individuals with their origins from different geographic locations. Closer scrutiny of the biological affinity of skeletons from other large burial grounds in the region might produce similar evidence, reinforcing Southeast Asia's status as a developing crossroads in routes of human migration, connectivity and mobility during the early and mid-Holocene.

Thus, the terminal Plesitocene to mid-Holocene archaeological record of SEA is starting to chronicle the significant technological and cultural changes that occurred across the region following the last glacial period, probably initially influenced by the insularization of islands on the Sunda shelf, drowning landscapes and resulting in human migrations. The records presented here illustrate how some of the spheres of contact and exchange developed (see also Bulbeck, 2008, for discussion on other potential geographic connections), and strengthened during the early and mid-Holocene on the mainland, across the Sunda region, and possibly from the southern Philippines to the Moluccas and into Melanesia. The widening geographic distribution of archaeological sites that possess inter-related cultural and technological traditions possibly indicate improving maritime technologies and inter-island movements of forager populations from the terminal Pleistocene to mid-Holocene across Southeast Asia.

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