
Chapter 4

The First Modern Humans at Niah, c. 50,000–35,000 Years Ago

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Introduction [TR, GB]

This chapter describes the evidence for the antiquity and character of initial human occupation at Niah. The chronological boundaries of the chapter are set by, on the one hand, the approximate age of the first main lithofacies in the West Mouth that was associated with human activity (Lithofacies 2, and that part of Lithofacies 2C interdigitated with it, as described in the previous chapter) and, on the other hand, the likely age of the mudflow (Lithofacies 3) that overwhelmed these earlier sediments.

As we described in Chapter 1, one of the major reasons for returning to the Niah Caves was to examine specific issues arising from the discovery of the Deep Skull in the West Mouth by the Harrissons (T. Harrisson?? - Dora 1958a; 1959c; 1970) and, related to this, to contribute to a broader understanding of human presence in Southeast Asia in the Pleistocene. The Deep Skull, dated indirectly to about 40,000 years ago by the radiocarbon dating of charcoal found near it, was for a long time the earliest dated modern human skull anywhere in the world (Vogel & Waterbolk 1963), but questions had been raised about the validity of the date and whether it could be used to date the skull or whether the skull was intrusive (i.e. younger) rather than *in situ* (Bellwood 1997; Hutterer 1977; Solheim 1977a or b??; 1983; Storm 2001). Whilst these site-based questions were important, there were others of significance for our understanding of human evolution and behaviour, in particular concerning the timing of the first appearance of anatomically modern humans (*Homo sapiens*) in Southeast Asia and their relationship to other species of humans ('hominins') in the region. These questions were critical to the debate about whether modern humans only deve-

loped in Africa and then spread across the globe, or whether they had also developed outside Africa from antecedent hominin populations such as *Homo erectus* (Brauer 1992; Trinkaus 2005). Questions about modern human adaptation and ecology were also significant given the debates about whether the rainforest was a limiting factor in the spread of humans and whether adaptation to it has only been a very recent, probably Holocene, event (Bailey & Headland 1991; Bailey *et al.* 1989; Brosius 1991; Colinvaux & Bush 1991; Endicott & Bellwood 1991; Townsend 1991 NOT IN REFS 1990?; and see Chapter 1).

We begin by summarizing what was known about human presence in the region before our fieldwork and the impact on the research agenda of new discoveries during it; and then consider the evidence collected by the project and how it contributes to this agenda.

The earliest hominin presence in Southeast Asia [TR]

The date of the earliest hominin arrival in Southeast Asia has been controversial for a number of years (Dennell 2009). The evidence derives from a series of deposits in Java that were deposited in high-energy environments, in the process incorporating earlier materials into them and presenting significant challenges in identifying appropriate material for dating and its potential relationship with the fossil evidence. Many of the hominin fossil localities were discovered in the late nineteenth and early twentieth centuries, making the original findspots difficult to identify today. The collections of material that have been recovered have been divided between institutional archives; associations of different faunal species may have become further mixed as a result. Work to redress

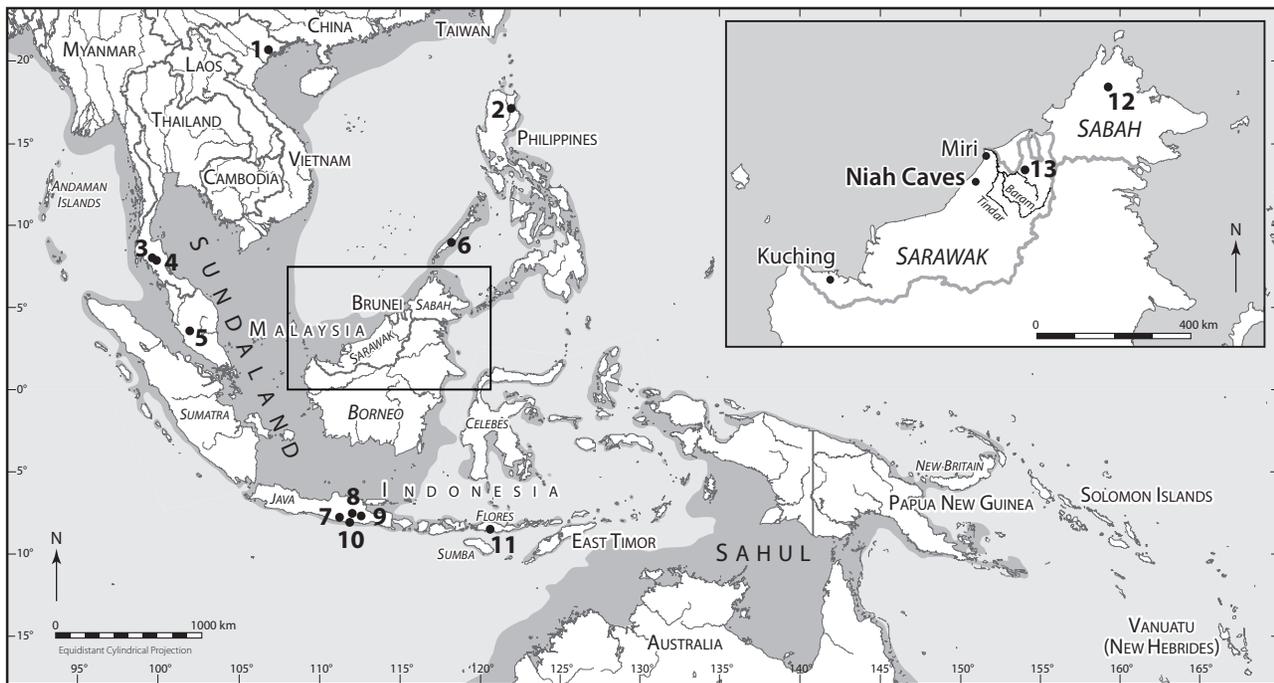


Figure 4.1. Southeast Asia, showing the likely position of the coastline 50,000–35,000 years ago, and the principal places mentioned in Chapter 4: 1. Keo Leng; 2. Callao Cave; 3. Lang Rongrien; 4. Moh Khiew; 5. Kota Tampan; 6. Tabon; 7. Sangiran; 8. Ngandong; 9. Parning; 10. Song Gupuh; 11. Liang Bua; 12. Mount Kinabalu; 13. Mulu. (Illustration: Dora Kemp.)

these problems has provided a better understanding of the issues, but there remain significant difficulties in associating particular hominin material with particular dates (e.g. van den Bergh *et al.* 2001; Huffman *et al.* 2005; 2006; Hyodo 2001; Hyodo *et al.* 2002; Larick *et al.* 2001; Langbroek & Roebroeks Roebrooks IN REFS 2000; Sémah *et al.* 2000; Swisher *et al.* 1994). A further complication is that the first inhabitants of the region do not appear to have consistently manufactured stone tools which are an indication of hominin presence when fossil material is lacking.

The first hominin presence in the region is dated to between 1.8 and 1.6 million years ago at Sangiran and Parning (Anton & Swisher 2004; Bettis *et al.* 2004; Sémah *et al.* 2000; Swisher *et al.* 1994; Fig. 4.1). There is a claim for the use of mollusc-shell tools evidenced by cut marks on animal bones from Sangiran before there is evidence of stone-tool use (Choi & Driwantoro 2007). The earliest dated stone tools, a series of worn and chipped stone flakes and pebbles also from the Sangiran region, are dated to 1.2 million years ago (Brumm *et al.* 2006; Sémah *et al.* 1992; 1996 NOT IN REFS; 2002 NOT IN REFS; Simanjuntak 2001; Widianto 2005). All the fossils dated to this early phase of hominin occupation can be placed within the *Homo erectus* grade (Kidder & Durbrand 2004 NOT IN REFS;

Kramer 1993; Rightmire 1990; Santa Luca 1980). Hominin presence has been inferred at 0.8 million years ago based on finds of stone tools in Thailand (Pope *et al.* 1986; Schepartz *et al.* 2000; Sorensen Sorenson IN REFS 1976) and on the island of Flores (Morwood *et al.* 1998; 1999). Finds of *Homo erectus* material DO YOU MEAN *Homo erectus* REMAINS OR ARTEFACTS? - DORA have also been discovered in caves in Vietnam and Myanmar (Ciochon *et al.* 1996; Demeter *et al.* 2000 NOT IN REFS; Maw 1993; Nguyen Lang Cuong 1992). Currently, however, there are no comparably early dates for hominins in the territory that became Borneo. Once established in the region, *Homo erectus* is found in Java, controversially dated at Ngandong to as recently as 40,000 BP (Swisher *et al.* 1996; Yokoyama *et al.* 2008) but, on the evidence of its association with a very large assemblage of extinct megafauna, more likely to date to c. 130,000 BP (Westaway *et al.* 2007a or b??).

Homo erectus has been interpreted as a grassland-adapted hominin that made regular use of stone tools (Gamble 1993 NOT IN REFS). The regional evidence from Southeast Asia contrasts CONTRADICTS? - DORA this theory in OWING TO?? AS THERE IS A?? - DORA the lack of stone tools (Reynolds 2008), but the question as to whether *Homo erectus*

populations here were solely exploiting grassland remains unresolved (Dennell & Roebroeks **Roebroeks elsewhere** 2005). Where study has been undertaken in Southeast Asia, there is evidence for the presence of grasslands and open woodland (Heaney 1991; Long *et al.* 1996; Morwood *et al.* 1998; 1998 **DATE REPEATED 1999??**; Storm 2002 **NOT IN REFS 2001?**; Sun *et al.* 2000; Tougaard *et al.* 2006 **NOT IN REFS Tougaard & Montuire 2006?**; de Vos 1995). The question then becomes one of the degree to which *Homo erectus* may have been exploiting other environments such as lowland woodland or even coastal mangrove swamp.

Modern humans in Southeast Asia [TR]

The date and context of the appearance of *Homo sapiens* in the region are as unclear as for *Homo erectus*. The fossil evidence for *Homo erectus* from Java has been claimed to show trends towards the modern human pattern, but the latest fossils remain identifiably *Homo erectus*, though with enlarged braincases and a more gracile appearance (Rightmire 1990; Santa Luca 1980; Yokoyama *et al.* 2008). Thus the debate as to whether a local descent model or a population replacement model best fits the evidence in this region remains to be resolved (Brauer 1992; Ke *et al.* 2000 **NOT IN REFS 2001?**; Pope 1992). Providing some support for the latter theory, though, is the mtDNA genetic patterning in Australo-Melanesian aboriginal groups such as the Malaysian Orang Asli: ancient maternal lineages not found in other populations of South and Southeast Asia are interpreted as suggesting that these people developed from a modern human population dispersal event c. 65,000–60,000 years ago (Macaulay *et al.* 2005). Further support for the model comes from Y-chromosome studies: a test for an East Asian origin of modern humans examining three sites on the Y chromosome tracked the mutations involved back to an African origin between 89,000 and 35,000 years ago (Ke *et al.* 2001). Such a date broadly accords with most current thinking about when modern humans might have spread from Africa across Asia (Lahr & Foley 1994; Stringer 2000).

There is a suggestion that a single molar possibly associated with faunal assemblages from Punung on Java dating to c. 128,000–116,000 BP may be from a modern human (Storm *et al.* 2005). This was the time of a major faunal turnover in the region, when various archaic species were replaced by a fully modern fauna that included rainforest-dependent species such as orangutan (van den Bergh *et al.* 2001; Westaway *et al.* 2007a or b ??). Such a date is close to the time when it is possible that modern humans may first have been expanding out from Africa into Arabia (Armitage *et al.*

2011; and see Chapter 1, p. 00). However, the association of the Punung tooth with the fauna from the site is uncertain and the date for the fauna also poses the question of how arboreal species such as orangutan reached Java, an island at this time.

Modern human fossils from Moh Khiew in Thailand are dated to c. 26,000 BP, and isolated teeth from Keo Leng in Vietnam are dated to c. 30,000–20,000 BP (Demeter *et al.* 2000 **NOT IN REFS**; Trinkaus 2005). Apart from Niah, the only other site in the region with relevant fossil remains of modern humans is Tabon Cave on the north coast of the Philippine island of Palawan, excavated in the 1960s by Robert Fox (Fox 1970). These were originally thought to date to c. 23,000 BP from a ¹⁴C date from the sediments in which they were found (Macintosh 1978), but direct U-series dating on two of the bones has returned dates of 31,000+80/–70 BP **CORRECT? - Dora** and 16,500+80/–70 BP **CORRECT? - Dora** (Dizon *et al.* 2002). A fragment of tibia from renewed work at the site has a U-series date of 47,000+110/–100 BP **CORRECT? - Dora**, though the excavators regard the latter date with caution given the absence at the site so far of other indicators of human presence of such antiquity (Dizon *et al.* 2002). An even older hominin right metatarsal from Callao Cave in northern Luzon in the Philippines has been dated to 67,000±1000 BP using U-series ablation. The element falls within the size range of diminutive modern humans such as the Agta foragers who still inhabit the region today, but has unusual morphological characteristics that do not fit comfortably within the range of variation of modern humans (Mijares *et al.* 2011 **NOT IN REFS 2010?**).

Given such a range of uncertain and widely different dates for modern humans in the region, establishing a reliable date for their initial presence at Niah was clearly a priority. The debate about their antiquity was still further complicated by the publication during our fieldwork of a small number of diminutive human fossils from Liang Bua cave on the island of Flores dating to 90,000–12,000 BP (Morwood *et al.* 2004; Fig. 4.2), with a brain size of only 400 cc (Falk *et al.* 2005). Though their status continues to be debated, arguments that they represent a modern human population that has suffered from dwarfism due to limited energy resources available to an island population (the associated elephant form *Stegadon* has also ‘dwarfed’) have generally been rejected in favour of them being an entirely new species, *Homo floresiensis* (Brown *et al.* 2004; Chiarelli 2008; Culotta 2008; Groves 2004; Henneberg & Thorne 2004; van Heteren & de Vos 2008), possibly ultimately derived from an Australopithecine-like ancestor (Dennell 2009).

The global sea-level lowering in response to



Figure 4.2. Liang Bua cave on the island of Flores and (inset) the diminutive *Homo floresiensis*. (Reproduced with permission of Mike Morwood; drawing: courtesy of Portia Sloan Rollings © 2004.)

glacier expansion in the major cold stages of the Pleistocene exposed huge areas of land in what is now Island Southeast Asia, and also linked New Guinea to Australia. However, open sea always separated these two landmasses, respectively termed Sundaland and Sahul (Fig. 4.1). Prior to the Flores discoveries, it had been argued that the populating of **Island Southeast Asia and** Australia was, of itself, evidence for modern human behaviour, including perhaps complex language, given the significant behavioural demands of planning and travelling that would have been involved in crossing the open sea (Davidson & Noble 1992). If, as has been claimed (van der Bergh *et al.* 1996; Morwood *et al.* 2004), the Liang Bua hominins must have had to cross open water to reach Flores (although a landbridge has been suggested: Groves 2004), their presence on the island, and significantly their use of a stone-tool technology that has been dated there to at least 800,000 BP, could be used to argue that behaviours once assumed to be restricted to *Homo sapiens* in this region were in fact already present long ago in our earlier ancestors.

The possible presence of a new human species on Flores, and the possible late dates for *Homo erectus* in Java, imply that modern humans at Niah could have been living in a region also inhabited by two non-modern human populations. The significant question then becomes: what was it that provided

modern humans with the competitive advantage to replace earlier, locally-adapted, populations? The key research questions for the new work at Niah posed by the debates about modern humans thus included:

- What was the date of the earliest human presence at the site?
- Were the first humans modern?
- What environments did humans encounter on first arrival, and thereafter?
- How did they exploit those environments?

We focused in particular on establishing a robust picture of the environmental setting for occupation; providing a dependable date-range for the Deep Skull and the associated human remains; and examining associated artefactual and biological material to provide an enhanced understanding of early human adaptation to the tropical conditions of northern Borneo. The key data relevant to this chapter all come from the West Mouth (Fig. 4.3, and see also Figs. 2.38 & 2.39).

The topography and local environment of the West Mouth [TR, KS, LK]

The topography of the northwest corner of the West Mouth *c.* 50,000–35,000 BP only partly resembled that seen today. There was a flat platform overlooking the river valley *c.* 30 m below, broken up along the dripline by two major speleothem towers 2–3 m thick, possibly

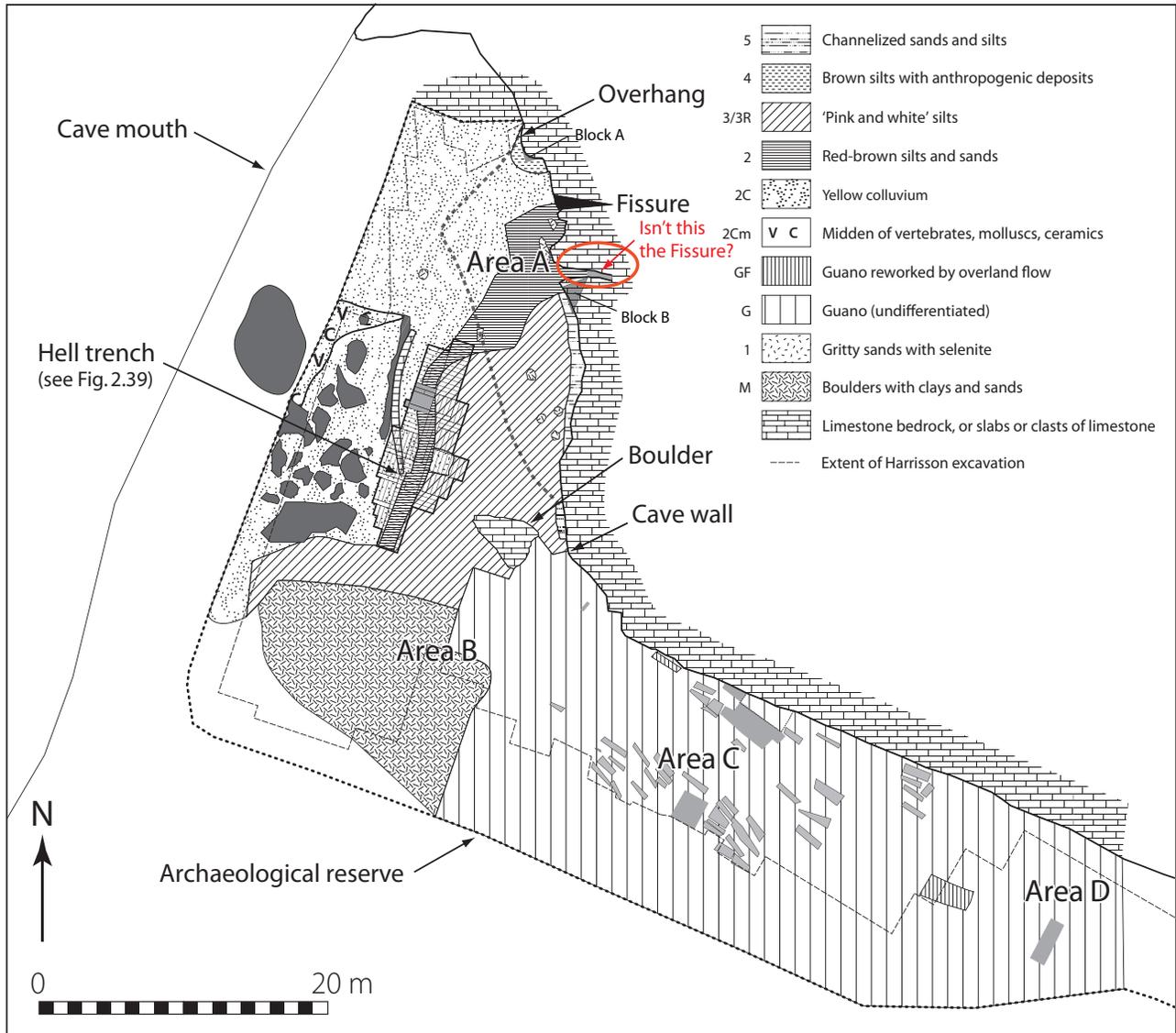


Figure 4.3. The archaeological reserve in the West Mouth of the Great Cave, showing key locations and features discussed in Chapter 4.

associated with smaller towers and trees, climbers and hanging vegetation growing in the entrance, much as today though probably more luxuriant and shading the West Mouth to a greater degree than now (Fig. 1.6). The platform would have been relatively flat and accessible from the east, south and north, with a sharp drop to the gorge on the western side. Behind the platform area was a short lip and then a relatively steep incline down into the West Mouth itself (Fig. 3.15). A broad and open trench ran parallel to the lip, 2–4 m below it, separating it from the guano mound and roof-fall deposits that rise steeply beyond it in the interior of the Great Cave. This gully ran into the overhang formed underneath a ledge on the northern

wall of the cave (Fig. 2.35).

The environment at the time of the first-evidenced human activity in the cave is shown by palynological results from monoliths A1M to A3M taken from Section 3.1 underneath the rock overhang, studied by CH (Fig. 3.21). These predate a radiocarbon date of $44,750 \pm 650$ bp or 46,321–49,593 BP (OxA-V-2076-15). Signs of burning — thermally-mature amorphous matter (which is generated in the soils under fires by heating of organic matter, thus indicating local burning within the cave entrance) and thermally mature material ('micro-charcoal') — appear briefly towards the end of a major interstadial or warmer episode provisionally correlated with NGRIP Interstadial 14,

which lies between 55,000 and 52,000 years ago (North Greenland Ice Core Project members 2004; Volume 2, Chapter 8). The pollen suggests that around the cave at this time there was closed and relatively dry lowland forest. Towards the end of the interstadial the forest gradually became more open and the amount of mangrove pollen declines, consistent with falling sea levels as world climates cooled. The early stages of the ensuing stadial are marked by evidence of vegetation opening up, coinciding with the return to the sequence of thermally-mature amorphous matter and thermally-mature matter.

Another guide to the nature of the vegetation in and adjacent to the cave entrance at the time of the first-evidenced human activity is the terrestrial molluscs from the deepest spits in the Harrisson excavations, preserved in the Harrisson Excavation Archive (studied by KS). These molluscs lived and died in the locality, rather than being gathered elsewhere and introduced by humans (Volume 2, Chapter 21). The sample (163 fragments, from 53 individuals from seventeen species) is dominated by species within the Asian Cyclophoridae, whose present-day habitats are moist woodlands and seasonally-flooded rainforest. Trees (though not necessarily their tops) are also the habitats of the arboreal *Amphidromus* spp. snails. The presence of a range of cyclophorid snails, together with *Macrochlamys* spp. and *Amphidromus* cf. *pictus*, all indicate a fairly dark and moist heavily forested environment in the immediate vicinity of the cave mouth, consistent with the interstadial indicators of the palynology.

Phytoliths (studied by LK) from context 3150 in the HP/6 baulk that we excavated (Fig. 2.48), one of the earliest contexts from which we definite archaeological evidence of human presence, appear to relate to stadial conditions. This sample was the richest of those examined, with 244 phytoliths. The taphonomic processes that might have introduced phytoliths into the West Mouth are discussed in Volume 2, Chapter 8. The general supposition is that most of them are in the sediments because they were part of plants or plant materials that were carried into the cave by humans, though in the case of the unusual assemblage from context 3150, the actions of wind and rain may also have played a role in its introduction into the colluvial (slope) sediments at the cave mouth. There were more phytoliths of grasses in this sample than in any of the others examined, though they still form a relatively low proportion (c. 10 per cent). Palms made up c. 25 per cent of the sample, which was dominated by arboreal forms including taxa of disturbed forest (such as Euphorbiaceae/*Macaranga* sp.). Phytolith forms consistent with Sterculiaceae (*Heritiera* sp.?

Melochia? multiple), Zingiberaceae, Euphorbiaceae (*Macaranga*, *Cleistanthus?*), Annonaceae, Fabaceae, Panicoid (Poaceae; multiple), Apocynaceae, Dilleniaceae, Burseraceae, Campanulaceae and Arecaceae are present. This very diverse assemblage probably reflects the vegetation around the cave mouth, given the mechanism of its deposition within the Lithofacies 2C colluvial sediments slipping into the West Mouth from the entrance platform (see Chapter 3 for the discussion of the formation processes of Lithofacies 2C).

As described in Chapter 3, the main sediment that accumulated in the channel in the period c. 50,000–35,000 BP, that we have termed Lithofacies 2, was a complex sequence of red-brown silts and sands formed primarily by episodic shallow streams flowing down towards the cave mouth from the interior guano mound and then turning at right angles to flow along the gully into the rock overhang and drain away through an inferred sink-hole at the base of the overhang, depositing sediment along the way. Sometimes shallow ponds and pools formed on top of the gully. Although the gully was predominantly damp, it dried out from time to time, micromorphological analysis of the sediments also revealing the kind of polygonal desiccation cracking that one can observe today in the mud crust of a drying pool (Fig. 3.17d). At the same time as Lithofacies 2 was accumulating, colluvial deposits were forming at the cave-entrance lip as a result of processes such as wind blowing material in, rainwater washing it in, rocks and stones accumulating from roof fall and speleothem collapse, and guano falling from bats and birds roosting in the roof. The resulting mix of sediments (Lithofacies 2C, termed the ‘yellow colluvium’) then slipped down a few metres from the cave lip into the basin, variously being reworked by the streams flowing into the basin or covering the drying-out Lithofacies 2 in the periods of desiccation. We were able to identify at least eight distinct colluvial flows. Occasionally more stable surfaces were established on the sloping surface of the colluvial sediments, between the cave entrance platform and the basin; six were identified (Figs. 3.19 & 3.20). These surfaces were stable enough to form soils in which small animals and insects such as robber wasps were able to burrow, causing bioturbation or mixing.

Climate and environment [CH, LK, PP, GR, CS]

The character of the Lithofacies 2 and 2C sediments indicates that the climate was prone to significant fluctuations in the period 50,000–35,000 BP, but overall was generally cooler and drier than today (Hunt *et al.* 2007). More detailed information comes from pollen,

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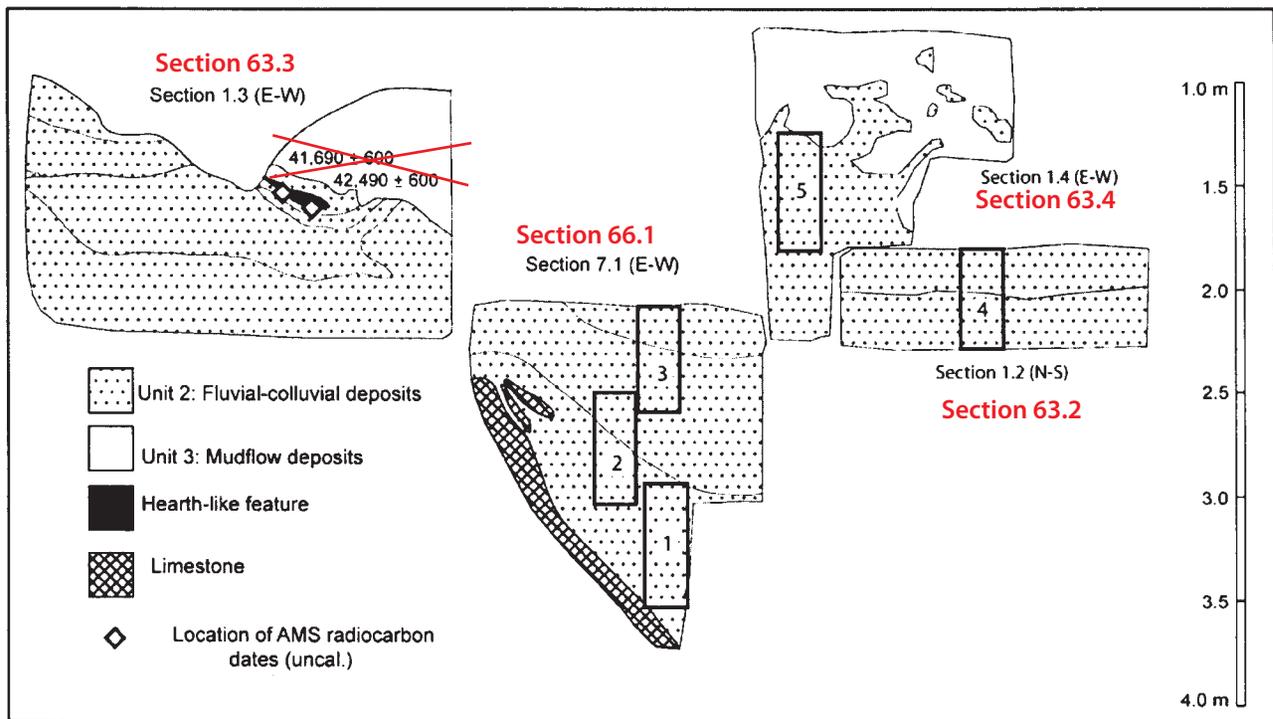


Figure 4.4. Simplified stratigraphy in the Hell Trench, showing the location of the monoliths taken for detailed sedimentological and palynological analyses. See also Figures 2.39 and 3.14. (Drawing: ??????????????)

palynofacies (the other particulate organic matter) and phytoliths extracted from a series of monolith samples taken (Fig. 2.40) through the thickest sequences in the Hell Trench, mostly in the south-facing exposures shown in Figure 2.46 (Hunt *et al.* 2007), and from the large numbers of small mammal bones recovered in the West Mouth excavations.

Unfortunately our main series of AMS charcoal dates was obtained from the palaeosurfaces within Lithofacies 2C in the HP/6 baulk on the western side of the Hell Trench, and the monoliths, taken from the eastern side of the Hell Trench, are only dated primarily in relation to the two ABOX dates of $41,800 \pm 620$ bp or $44,344\text{--}46,137$ BP (Niah-311) and $40,100 \pm 580$ bp or $43,071\text{--}44,936$ BP (Niah-312) obtained by Michael Bird in 2001 from hearth-like masses of ash and charcoal at the top of Lithofacies 2 just below its contact with the 'pink and white' guano mudflow, Lithofacies 3 (Fig. 4.4). The top of the sequence of three overlapping lower monoliths taken from Section 7.1 lay immediately below the location of these dates. No ^{14}C dates were obtained from the sediments lower in this profile, and attempts to obtain OSL dates here were thwarted by the paucity of quartz grains and the possible incorporation of younger material by bioturbation and re-working of older material (sandstone quartz) (Stephens *et al.* 2007; and Volume 2, Chapter 13). Dat-

ing the pollen sequences therefore has to be based on correlations between proxy climatic indicators in the monoliths and global climatic trends (see below).

The grain-size analysis of the sediments in Monoliths 1–3 shows at least ten cycles of change consistent with the trough cross-bedding observed in the cleaned sections. These most probably reflect pulses of water-flow in the channel, with increasing turbidity causing coarsening and slower flows causing 'fining up' (Fig. 4.5). The samples with over 50% clay at depths of 213–208, 193, 168, 148, 128, 113, 88–83 and 63 cm probably reflect phases of quiet water, as clay settled out of residual pools. The dominance of silt-size material through the profile might be the result of loessic material blowing into the cave, perhaps an indicator of cool open landscapes on the Chinese mainland, as wind-blown loess has been noted in late Pleistocene sediments in cores from the South China Sea (Sun *et al.* 2000). Modern sediments on the Subis Limestone contain little silt.

Eleven pollen assemblage-biozones (termed simply 'zones' below) were initially distinguished in the same sediments, on the basis of changes in pollen, spores, algae and palynofacies. The pollen assemblages are summarized in Table 3.2 and shown graphically in Figure 4.6, and the palynofacies are shown in Figure 4.7. Sharp boundaries between the

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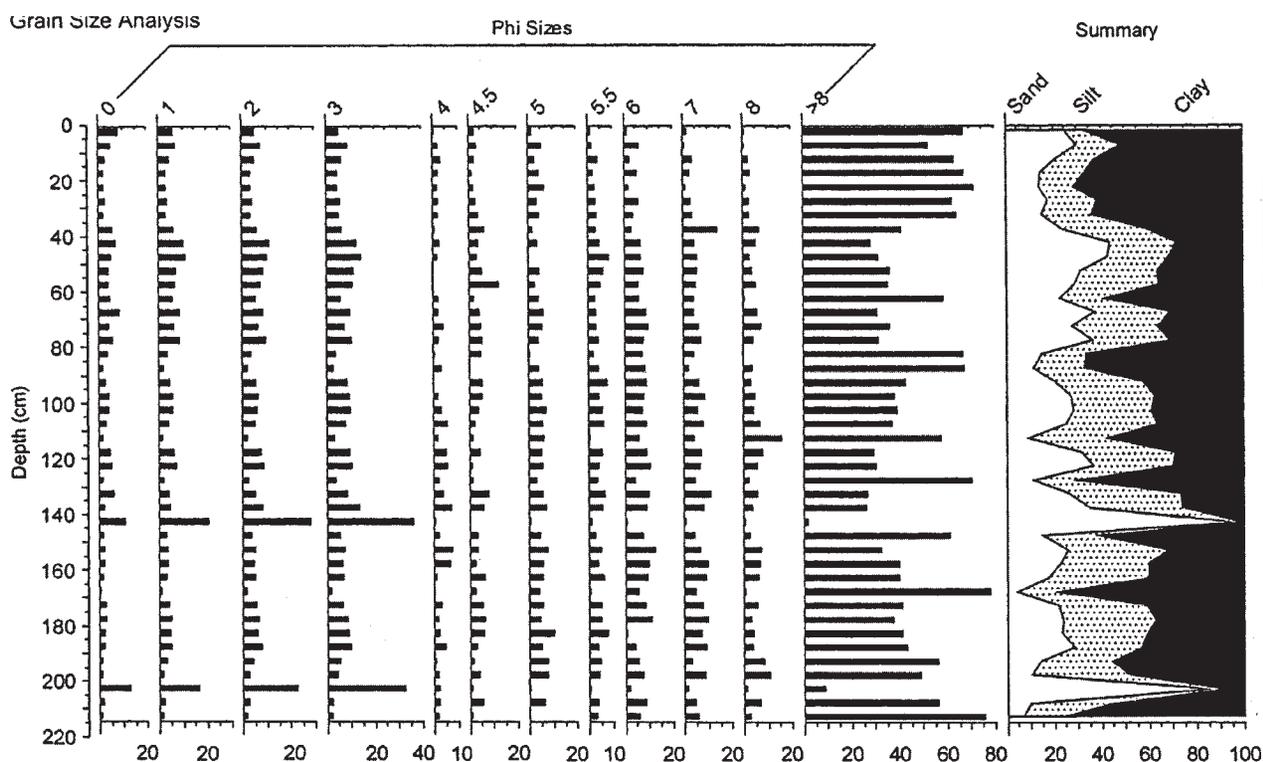


Figure 4.5. Grain-size analysis of the Hell Trench monoliths 1-3. (After Hunt et al. 2007.)

pollen zones are in some cases indicative of discontinuities in deposition, making it conceivable that entire climatic events are not represented. However, given the pattern of vegetational change, there are probably not very long gaps in the sequence. Hunt *et al.* (2007) argue that the pollen zones characterized by high percentages of lowland forest taxa, including high percentages of coastal mangrove vegetation, can be correlated with global interstadial phases when climates were warmer and sea levels higher than at glacial maxima, and that the pollen zones with high percentages of open ground or grassland taxa and rare mangrove pollen can be correlated with global stadial phases when climates were cooler and sea levels lower.

Zone H-1 is dominated by *Podocarpus*, a montane and *kerangas* forest conifer not often found below 100 m asl today (it thrives on Mount Kinabalu, for example and on well-drained acid sands at lower altitudes). This is associated with drought-tolerant taxa such as *Myrica*, *Casuarina* and *Oleaceae*. The abundant *Saeptodinium* sp., though, reflects an algal bloom in relatively deep water. The inference is of a relatively dry cold period, but with episodic substantial rainfall events. Zones H-2 to H-4 signify a significantly cooler and drier phase, the vegetation around Niah being dominated by open-ground taxa such as *Poaceae* and *Cyperaceae* and herbaceous taxa

such as *Chenopodiaceae*, *Asteraceae*, *Lactutae* and *Artemisia*. This vegetation represents a landscape and environment markedly different from those of today, though a rise in freshwater swamp and lowland forest taxa in Zone H-3 indicates a warmer and wetter oscillation with a concomitant return of forest. Zones H-5 to H-7 witnessed a significant expansion of lowland, montane, coastal and swamp forest in response to a warmer and wetter climate (also evidenced by the presence of the strictly montane ferret badger, *Melogale everetti*, in the archaeological record at this time: Medway 2000 **NOT IN REFS**). This was followed by a cooler and drier oscillation marked by the expansion of pollen and spores of open-ground taxa (Zone H-8).

Zones H-9 to H-11 have high frequencies of mangrove and lowland forest pollen. Whilst some of the mangrove pollen might have been brought into the cave from distant coastal swamps by fruit-eating bats, the frequency of pollen of the coastal taxon *Avicennia*, which is not found in the guano of bats using the West Mouth today (Hunt & Rushworth 2005a), is interpreted by Hunt *et al.* (2007) as evidence for a high sea stand at a time of a warm though increasingly dry environment. This conclusion is supported by the numbers of diatoms of estuarine species such as *Diploneis* spp. in the same sediments, suggesting that, however they reached the cave (on the feet or

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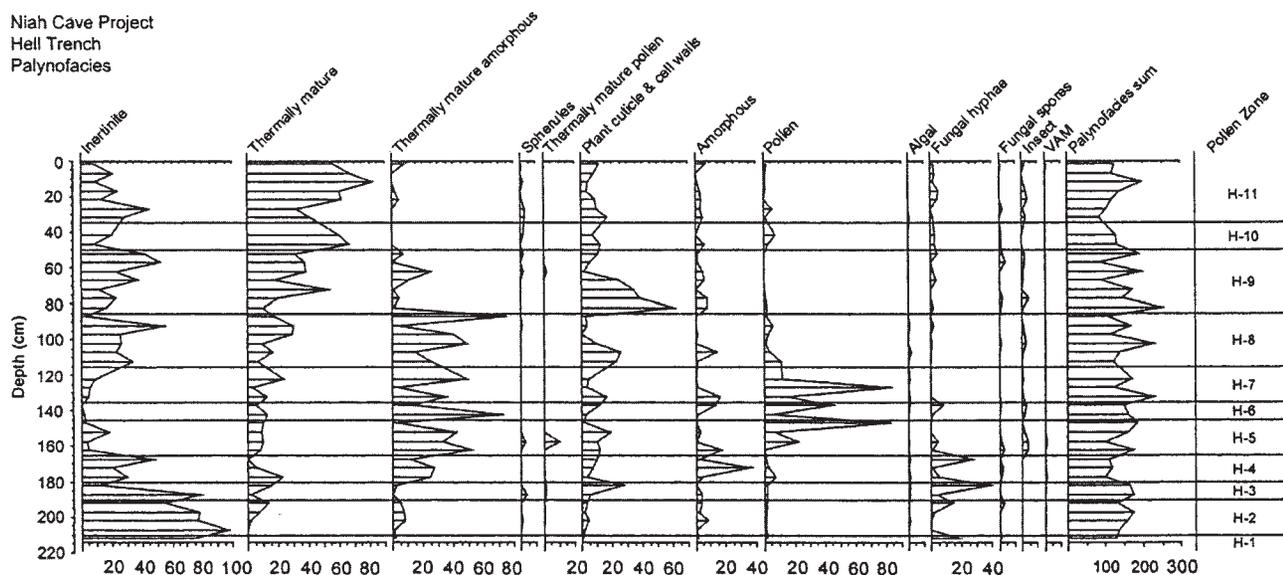


Figure 4.7. Palynofacies analysis of the Hell Trench monoliths 1–3. All organic particulates are shown as percentages of total palynofacies. (After Hunt et al. 2007.)

bodies of people or animals, or in their stomachs), they came from estuarine waters that must have been reasonably accessible from the caves. At the same time, however, the phytoliths from these sediments point to mainly lowland tropical forest near the West Mouth: Poaceae phytoliths are absent or rare, and phytoliths of mangrove taxa such as *Nyssa* palm are absent; whilst Rhizophoraceae taxa do not produce diagnostic phytoliths, in other mangrove environments phytolith samples are dominated by a variety of arboreal forms not seen in these samples (sphere type: Kealhofer & Piperno 1994 **NOT IN REFS**; 1996 **NOT IN REFS**). Clearly some closed tropical forest remained near the West Mouth at this time, despite the dominance of mangrove swamps beyond the Gunung Subis.

Given their adjacency to the Niah-311 and Niah-312 ABOX dates of c. 44,000–47,000 BP (Fig. 4.4), Hunt *et al.* (2007) concluded that the topmost Zones H-11 to H-9 probably correlate with Interstadial 12 recognized in the GRIP cores in Greenland, which is dated to c. 47,000–45,000 BP (North Greenland Ice Core Project members 2004). On this linkage, the next warm phase, represented by Zones H-7 to H-5, would correlate with GRIP Interstadial 13, dated to c. 49,000–48,000 BP, and the basal Zones H-1 to H-4 would relate to the preceding stadial. Certainly the pollen sequence correlates with the evidence of the Lithofacies 2 and 2C sediments, of a climate regime generally cooler and drier than today that favoured more open landscapes and with the sea somewhat distant from the caves, punctuated by warmer and wetter oscillations characterized by extensive lowland

forest and mangrove swamp indicative of estuarine and coastal environments encroaching on the Gunung Subis. The phytolith evidence suggests a more subtle pattern of vegetation change within the immediate environment of the West Mouth, but with the same evidence of shifts from wetter to drier lowland forest, along with indications of small-scale but continuing disturbance by people (see Forest Disturbance, below).

Further insights into local ecologies at Niah come from the large numbers of rat, bat, swiftlet and shrew bones from the Hell deposits. Ongoing morphometric determinations of the huge quantities of chiropteran (bat) bones by PP, CS and GC have led to the identification so far of three fruit bat and thirteen insectivorous bat taxa (Table 4.1). The list represents the minimum number of different bat species represented in the archaeological record, because identification to a specific taxon within many genera is restricted by indistinguishable morphological characteristics and overlapping body size.

The composition of the ancient and modern bat communities in the Niah Caves appears to be very similar, but with a few notable exceptions (Stimpson 2010). The wrinkled-lipped bat *Chaerephon (Tadarida) plicata*, for example, is the most common bat species in the Niah archaeological deposits from the oldest dated sediments to the first millennium AD (its latest attested occurrence is in context 1007 at Lobang Hangus dated to 1280±27 bp or 1174–1283 BP: OxA-13937), but is absent from the caves today, though found in large numbers in the Mulu caves to the east (Chapman 1985; Cranbrook & Piper 2007a; Hall 1996 **NOT IN REFS**).

Table 4.1. Species of bats represented in the Pleistocene archaeological deposits in the West Mouth (* additions by Christopher Stimpson to lists published by Aldridge & Medway 1963, Cranbrook 2000, Cranbrook & Piper 2007a; ** at least four species of bent-winged bats are present, but only two have been identified with certainty).

Latin name	Common name
Pteropodidae	Old World fruit bats
<i>Eonycteris spelaea</i>	cave nectar bat
<i>Rousettus</i> cf. <i>amplexicaudatus</i>	Geoffroy's rousette
<i>Cyanopterus</i> cf. <i>horsfieldi</i>	Horsfield's fruit bat
Emballonuridae	Sheath-tailed bats
<i>Emballonura</i> sp.	sheath-tailed bat
<i>Taphozous</i> cf. <i>melanopogon</i> *	black-bearded tomb bat
Rhinolophidae	Horseshoe bats
<i>Rhinolophus trifolius</i>	trefoil horseshoe bat
<i>Rhinolophus borneensis</i>	Bornean horseshoe bat
<i>Rhinolophus</i> cf. <i>luctus</i> *	great woolly horseshoe bat
Hipposideridae	Roundleaf bats
<i>Hipposideros diadema</i>	diadem roundleaf bat
<i>Hipposideros larvatus</i>	intermediate roundleaf bat
<i>Hipposideros galeritus</i>	Cantor's roundleaf bat
Vespertilionidae	Common bats
<i>Myotis</i> spp.	Myotis bats
<i>Miniopterus</i> cf. <i>schreibersi</i>	common bent-winged bat
<i>Miniopterus</i> cf. <i>australis</i>	lesser bent-winged bat
<i>Miniopterus</i> sp.**	bent-winged bat
Mollossidae	Free-tailed bats
<i>Cheiromeles torquatus</i>	naked bat
<i>Chaerephon</i> (<i>Tadarida</i>) <i>mops</i> *	free-tailed bat
<i>Chaerephon</i> (<i>Tadarida</i>) <i>plicata</i>	wrinkle-lipped bat

Hundreds if not thousands of the bones of this bat were also found in the Late Pleistocene guano exposed by a quarry pit in the northern chamber of the Great Cave discussed in Chapter 3 (Fig. 3.8), including the unfused humeri and femora of juveniles, presumably from individuals that had fallen from roosts above. The moderately-sized Geoffroy's Rosette (*Rousettus* sp. cf. *amplexicaudatus*), the most common fruit bat in the archaeological deposits, is also absent from the modern Niah cave fauna and is generally uncommon in Borneo today (Aldridge & Medway 1963; Cranbrook & Piper 2007a), suggesting that changes in the regional environment have influenced its biogeographic distribution. The frequency of the cave nectar bat *Eonycteris spelaea* in the archaeological deposits (a species now almost exterminated at Niah by illegal hunting) indicates that mangrove forest, its principal source of food, must have been within its c. 20 km foraging range (Cranbrook & Piper 2007a), confirming the evidence of the palynology.

Four different rat taxa have been tentatively identified in the Niah archaeological material: the long-tailed giant rat (*Leopoldamys sabanus*), Muller's rat (*Sundamys muelleri*), the spiny rat (*Maxomys* sp.), and at least one species in the genus *Rattus*. The first

three all inhabit tropical rainforest and secondary woodland. Only two *Rattus* species are certainly native to the island of Borneo, the lowland ricefield rat (*Rattus tiomanicus*) and the largest of all the *Rattus* species, the montane Kinabalu rat (*Rattus baluensis*). According to their mandibular dentition the West Mouth archaeological specimens fall within the size range of the Kinabalu rat. Today this species is restricted to the upper slopes of Mount Kinabalu, between 2100 m and 3600 m above sea level, which does appear to be its natural distribution rather than, for example, the product of intra-specific competition. The same is true of the green magpie (*Cissa chinensis*), a species of hill and submontane forests in Borneo today (Smythies & Davison 1999, 627), a right humerus of which was identified by CS in the vertebrate remains from the lower levels of the Hell Trench (HE/2: 105–108 inches). Another submontane species, Bulwer's pheasant (*Lophura bulweri*), may be represented by an intermediate-sized gallopheasant femur in the Harrison Excavation Archive from HE/2: 111 inches, originally identified from its attached label as 'human bone from near Deep Skull'.

It has been suggested at the regional scale that the boundary between lowland and montane forest formations was lowered by c. 900 m during the coldest phases of the Pleistocene, such as during the local expression of the Last Glacial Maximum (Flenley 1998; 2005; van der Kaars & Dam 1995; Newsome & Flenley 1988). Such a lowering would not have been enough to bring the Kinabalu rat or the green magpie down to the Niah Cave at near sea level, but 900 m may be a minimal figure because vegetational zones on isolated massifs in Borneo are considerably lower than on Mount Kinabalu (Ashton 2003) and it is possible that for brief periods montane environments descended by as much as 1200 m: *Balanophora*, for example, found at 2400 m on Mount Kinabalu today, along with other montane species such as *Acer*, *Alnus*, *Albizia* and *Schefflera*, occur in the stadial phases of the Hell sequence. In the case of the Niah rats, it is possible that they actually belong to the lowland ricefield rat, *Rattus tiomanicus*, its size diminution in the Holocene in response to environmental change — known to have affected rats along with some other species in Island Southeast Asia (Cranbrook 1986; Hooijer 1962) — having led to the large Pleistocene rat bones at Niah being wrongly identified as belonging to the Kinabalu rat. The ricefield rat prefers more open terrain than the long-tailed giant rat, Muller's rat, and the spiny rat, implying the existence of disturbed habitats as well as tropical rainforest around Niah Cave, a conclusion that chimes with other evidence (see Forest Disturbance). The colder climate of the Pleistocene is

also evident from the presence of the Bornean shrew *Crocidura foetida foetida*, a species adapted to cold upland habitats (Cranbrook & Piper 2008).

The palaeoclimatic signatures of the different data sets discussed above — sediments, pollen, phytoliths and microfauna — are complex and ambiguous, and poor chronological resolution prevents detailed comparisons. Nevertheless, the picture that emerges is that, however much the climate oscillated between wetter and drier episodes in the period c. 50,000–35,000 BP, the landscape that was exploited by the hominins using the Niah Caves through this period consisted of a mosaic of different vegetation types that normally included montane forest, disturbed or open ground, closed canopy lowland forest and mangroves.

Dating human presence in the West Mouth: the direct evidence [TR, MB, AP, PP, RR]

The discovery of the Deep Skull, that of a young adult female of Australo-Melanesian stock (Brothwell 1960; Birdsell 1979; Fig. 1.17), was described in Chapter 1. The findspot no longer exists, having been excavated away in 1958, but the recording of the discovery by Barbara Harrisson is clear, the photographic record confirms her account, and notes by Tom Harrisson also make clear the care taken whilst excavating this area: materials were collected in small three-dimensional units, with depths below ground surface repeatedly measured. The detailed contextual information regarding the Deep Skull's location in relation to Lithofacies 2 and 2C was discussed in Chapter 3.

When first revealed on 7 February 1958 (Fig. 1.16), the exposed part of the (inverted) Deep Skull was treated with shellac and left until 15 February 1958, when excavation began in the presence of Tom Harrisson and Professor Ralph von Koenigswald. The entire skull was then lifted on 18 February 1958 after it had been treated with nylon and shellac. Charcoal collected the previous year at 104–107 inches below the ground surface and near the eventual findspot of the skull (Fig. 1.15) yielded an uncalibrated (but corrected for Suess effect: Vogel & Waterbolk 1963) radiocarbon date of 39,820±1012 **1000? - Dora** bp (GrN-1339C). Calibrated, the date would be 42,391–45,629 BP. In a letter to Kenneth Oakley at the Natural History Museum in London dated 18 March 1959 (now in the Harrisson Excavation Archive), Barbara Harrisson affirmed that this charcoal could clearly be associated with the skull: the layer was

very distinct and runs, unevenly, about 3–5" broad, between 98" and 105" depth. It is rich in carbon remains and contains hearth rings. H6, the skull's trench, holds the '40,000 C-14 layer' between 104"

and 107". It is rich in carbon remains and contains hearth-rings. The top of the crown lay downwards (109–110") associated with one limb-bone and lumps of charcoal...The upper dentition lay upwards (106").

Another date of 41,720±1012 BP **calibrated?** (GrN-1338C) [APPENDIX says GrN-1338 41,700±100 bp 44,760–45,623 BP - DORA] originally published by de Vries and Waterbolk (1958) was also influential, but subsequently found to be a mixture of samples and was regarded by de Vries as invalid (Krigbaum 2001).

The same letter to Oakley states that the skull was found with faunal remains that included pig, deer, rodents, tortoise and fish (including a possible marine species), snake and birds. The skull was not associated with any specific artefactual remains, though a stone flake was found directly below it, at a depth of 118 inches. Pollen extracted from a spit at a depth of 138–140 inches by G. Renouard of the Brunei Shell Petroleum Company contained mangrove taxa (undated letter EXO/B/144.10 in the Harrisson Excavation Archive). Another indicator of the antiquity of the skull was taken to be the remains at depth in square H/17 of an extinct species, the giant pangolin, *Manis* sp. cf. *palaeojavanica* (Piper *et al.* 2007a or b??; Fig. 4.11).

We obtained an AMS-ABOX date of 35,000±400 bp or 38,985–41,043 BP (OxA-15126) on archived charcoal from Harrisson's trench HE/11, which was within a metre of the Harrisson trenches H/6 and H/19 that yielded the Deep Skull, and from a 3-inch spit stratigraphically equivalent in depth to deposits directly beneath it (i.e. 111–114 inches). A second sample of archived charcoal labelled in Tom Harrisson's handwriting 'charcoal by Deep Skull' (but without further contextual information) yielded an AMS-ABOX date of 35,510±340 **350? - Dora** bp or 39,675–41,503 BP (OxA-V-2076-16). Charcoal recovered from matrix collected during Don Brothwell's original examination of the Deep Skull (within and adhering to the skull) had insufficient carbon to produce a date, though pollen in the matrix was of grassland vegetation suggestive of a cool dry climate. The matrix had a distinctive geochemistry, very high magnetic susceptibility and contained fairly sharp, euhedral, quartz crystals, mostly of hexagonal bipyramid form and 4–8 mm in diameter. Two small fragments from the skull fragment that are currently held at the Natural History Museum, London, were dated by AP using U-series dating, using the Diffusion-Adsorption (D-A) model to account for U uptake (Millard & Hedges 1996; Pike *et al.* 2002; Pike *et al.* 2005; Volume 2, Chapter 15; Fig. 4.8). The dates returned by this method were in moderately good agreement with the radiocarbon samples: 37,000+500/–470 BP and 34,500±300 BP (at 2 sigma), giving an error-weighted average of 35,200±260 BP.

The human remains found near the Deep Skull in fact included an almost complete left femur and a right proximal tibia fragment (Krigbaum & Datan 1999; 2005). A human talus was apparently sent with the faunal remains from the Deep Skull location to Leiden for analysis (Hooijer 1963), though we have not been able to locate it in the Leiden collections. A further 27 human cranial fragments were found by PP and RR in deposits that they believe can be equated stratigraphically with the Deep Skull layer, some 10 m to the south, though no further dating evidence is available for these. The indications are, therefore, that the Deep Skull was part of a series of human remains of more than one individual that were buried in the Lithofacies 2 silts. The presence of the femur and tibia, both substantial long-bone fragments, more or less in direct association with the skull, can be taken as reasonable evidence against any significant transportation of the human remains through fluvial action during the deposition of Lithofacies 2 silts, for current flow of any magnitude would have separated the skull from post-cranial bones owing to differences in their shape and buoyancy.

The U-series dates from the skull and the ^{14}C dates from the charcoal collected by the Harrissons from immediately around it are within a sufficiently close range to suggest that the 1958 dating of the Deep Skull to around 40,000 BP was largely correct, though our more precise evidence suggests a slightly younger age of c. 37,000/36,000 BP. However, it is also important to note that the latter date is considerably later than the age of the surviving sediments 0.75 m to the north of where we think the skull was found, because there we collected the charcoal that yielded the Niah-310 and Niah-311 ABOX dates of c. 44,000–47,000 BP from good stratigraphic contexts near the top of Section 1.3 63.3??, i.e. above the assumed depth of the skull (Fig. 4.4). The fact that the pollen zones in these sediments correlate with global climatic trends prior to the time period of the Niah-310 and Niah-311 dates and that the pollen in these zones is rather different from the pollen recovered from the sample from the skull matrix is a further indication that the skull was

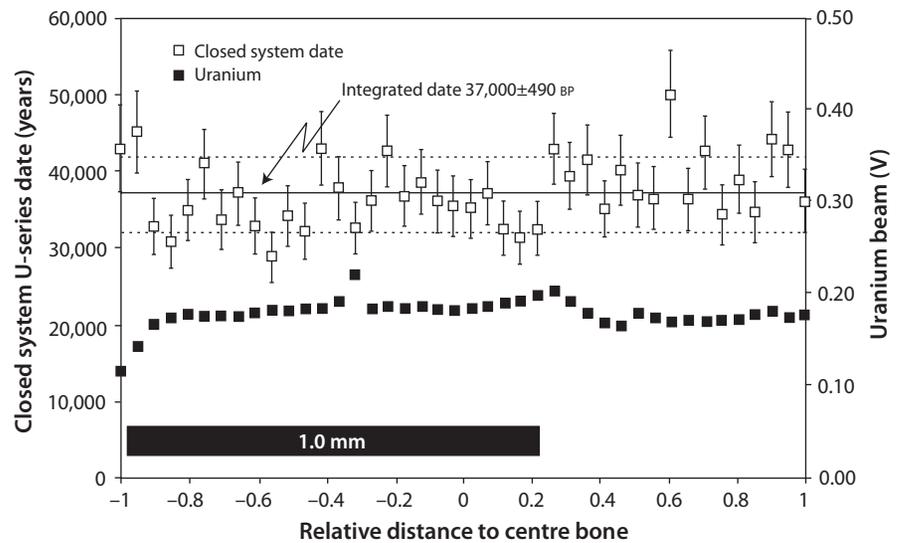


Figure 4.8. Uranium and U-series date profile for Deep Skull fragments: (above) APN1Ah1: errors on the individual points are 1σ , but the error on the integrated age is 2σ ; the integrated $^{230}\text{Th}/^{232}\text{Th}$ activity is >50 , indicating low levels of detrital contamination; (below) APN1AH2: the solid line shows the maximum likelihood date using uranium uptake according to the diffusion absorption model; errors on the individual points are 1σ , but the error on the D-A range is given at 95% confidence; the integrated $^{230}\text{Th}/^{232}\text{Th}$ activity is >50 , indicating low levels of detrital contamination. (Analysis by Alistair Pike.)

younger than the sediments in which it was found. Similarly, the geochemistry of the matrix sample is significantly different from the geochemistry of the sediments at equivalent depth in the Hell Trench. The presence of quartz crystals, not found in any other context at Niah and not present in any part of the stratigraphic sequence in the adjacent lowlands suggests the strong possibility that the skull was part of a cultural deposit inserted into the sediments of Lithofacies 2, although this hypothesis is impossible to investigate now because of the removal of all the sediments around the skull.

Dating human presence in the West Mouth: the indirect evidence [TR, CH, PP, RR, CS]

Human presence in the cave is also confirmed by the indirect evidence of animal bones (Volume 2, Chapter 20) and palynology (Volume 2, Chapter 8).

A significant proportion of the micro-faunal remains identified in the Hell Trench and adjacent assemblages, as well as some of the larger lizards (e.g. monitor lizard, *Varanus* sp.) and snakes (e.g. the cave racer *Orthriophis taeniuris* or *Elaphe taeniura*), in all probability represent part of the Great Cave's natural faunal community. Whilst it is notoriously difficult to distinguish between anthropogenic and

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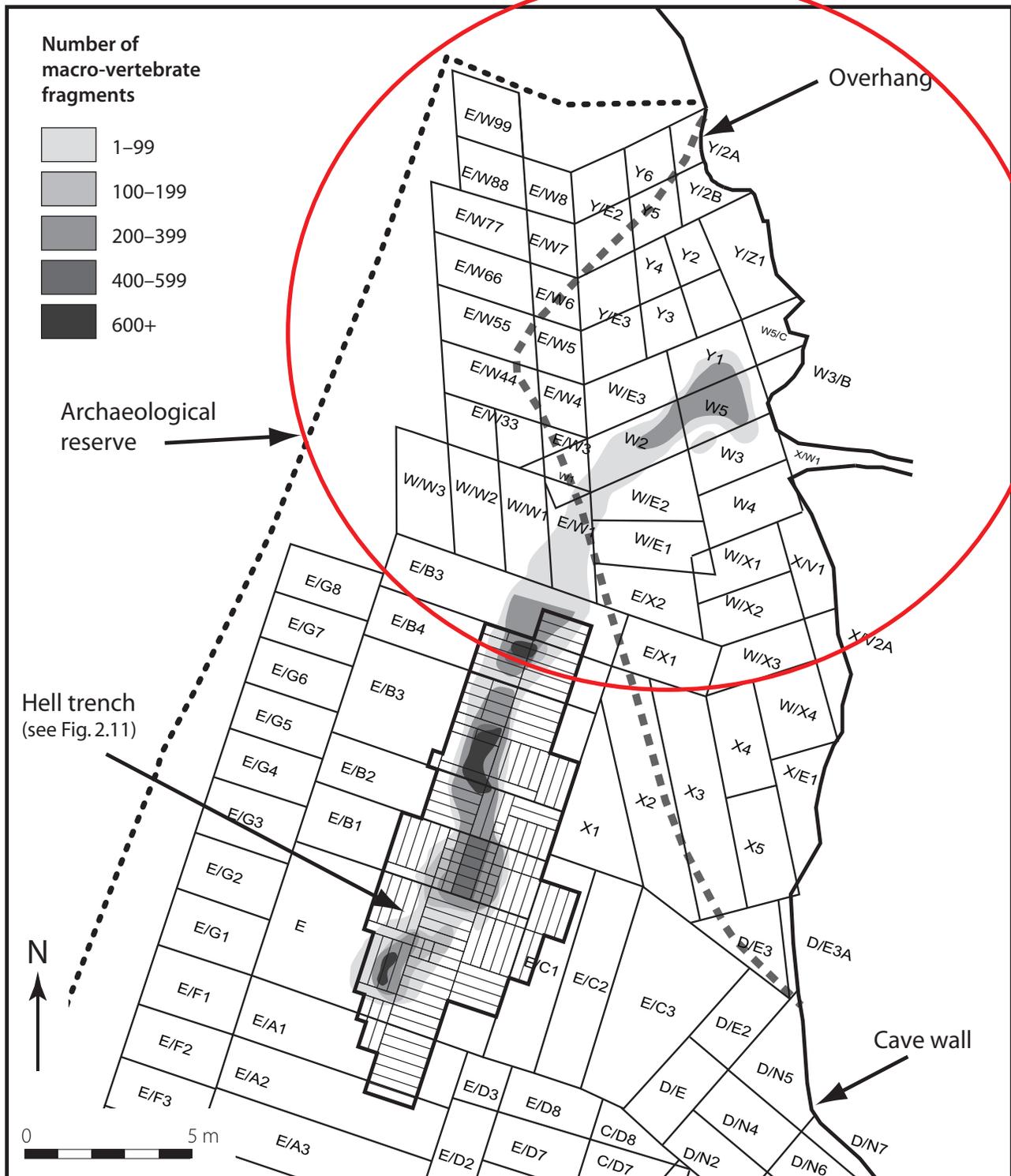


Figure 4.9. The approximate alignment of the 'bone under ash layer' in the West Mouth, along the base of the Hell Trench and north to the rock overhang, reconstructed from the distribution of the vertebrate fauna preserved in the Harrison Excavation Archive. (Analysis by Philip Piper and Ryan Rabett; illustration: Ryan Rabett, Lindsay Lloyd-Smith and Dora Kemp.)



Figure 4.10. An example of a discrete bone concentration within the ‘bone under ash layer’ in the Hell Trench. (Harrison Excavation Archive photograph na 573, reproduced with permission of Sarawak Museum).



Figure 4.11. Bones of the extinct giant pangolin *Manis sp. cf. palaeojavanica* found in square H/17 at the same depth as the Deep Skull in H/6. Its occurrence was important evidence for the likely antiquity of the Deep Skull. (Harrison Excavation Archive photograph na 362, reproduced with permission of Sarawak Museum.)

non-anthropogenic mechanisms in the deposition of skeletal remains of small vertebrates (e.g. Boy 2002 **NOT IN REFS**; Stahl 1995 **NOT IN REFS**), the presence of butchery marks suggests that some of these species, such as monitor lizards, the naked bat (*Cheiromeles torquatus*), rousette fruitbat (*Rousettus sp.*), black nest swiftlet (*Aerodramus maximus*) and mossy nest swiftlet (*Aerodramus salanganus*), may have been exploited routinely by early human groups coming to the cave (Stimpson 2010). The precipitous nature of the gorge below the West Mouth also makes it highly unlikely that the large terrestrial mammals or aquatic reptiles, such as soft- and hard-shelled turtles that are represented in the Harrison fauna, could have reached the cave of their own volition: internal passage through the cave system from lower levels is possible, but it is complex, unlit and inhospitable to anything other than adapted cave-dwelling species.

Apart from their general association with human remains, other characteristics of the Pleistocene faunal assemblage from the West Mouth confirm its anthropogenic origin. The detailed mapping by PP and RR of the distribution of the animal bones excavated by the Harrissons from the ‘bone under ash layer’ at the base of the Hell Trench and adjacent deposits, where this could be reconstructed from the more careful

seasons of excavation, demonstrates that the bones formed a sinuous and undulating concentration along the line of the channel running parallel to the cave lip into the rock overhang (Piper & Rabett 2009b; Rabett *et al.* 2006; Fig. 4.9). The channel, of course, drained the water that flowed intermittently from the cave interior into the sinkhole under the rock overhang, a process that created Lithofacies 2. As mentioned earlier, the fact that the Deep Skull and the associated limb bones were in Lithofacies 2 suggests that the water did not flow strongly enough at that time to move large objects any substantial distance.

Also, the Harrissons found several examples of semi-articulated bone elements (Fig. 4.10) in what we can now recognize as the channel-fill sediments, evidence that bones have not moved very much as well as indicating that carcasses of animals killed elsewhere were being brought to the West Mouth for butchery there. Several other examples were noted of skeletal elements from a single taxon being found in close proximity to one another: for example, eight fragments of the now extinct large anteater **GIANT PANGOLIN??** (*Manis sp. cf. palaeojavanica*), including a femur, humerus, metapodials and phalanges, were recovered from within 0.5 m of each other in the central part of Hell Trench (Fig. 4.11). This suggests that

Please supply original photographs or high-resolution scans - DORA

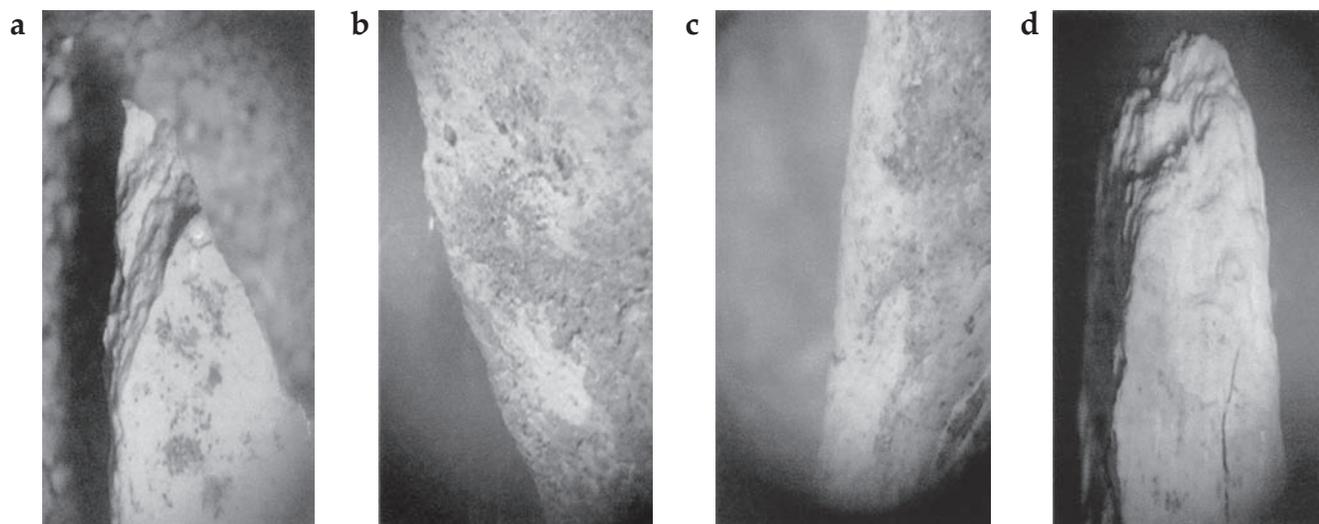


Figure 4.12. Examples of progressive degrees of fracture-edge abrasion on bone fragments from the Harrison Excavation Archive: (a) fragment from HP/8(B) 84–87 inches, with no abrasion; (b) fragment from HP/8(B) 99–102 inches, with slight abrasion; (c) fragment from X/W1 36–48 inches, with moderate abrasion; (d) fragment from X/W1 36–48 inches, with severe abrasion. (a) Photographed at $\times 15$ magnification, (b)–(d) at $\times 10$ magnification. **IS MAGNIFICATION CORRECT?** (Photographs: Philip Piper and Ryan Rabett.)

one animal was deposited either partially articulated or that bones from it were dumped at the same time, in the same location, in a discrete butchery event (Piper *et al.* 2007b). Seventeen elements of what are probably the partial skeletons of at least two leaf monkeys were noted in the fauna from a depth of 105–111 inches in trenches HE/2 and HE/4.

It is noticeable that most of the animal-bone fragments attributable to large (e.g. Suidae- or pig-sized) and intermediate (e.g. Cercopithecidae- or monkey-sized) mammals are very small — under 20 mm in size — and that the identifiable skeletal elements of the bone assemblage are dominated by small extremities or isolated teeth. Given the meticulous nature of the recovery process practised by Barbara Harrison’s Hell Trench team and the excellent state of bone preservation, had larger elements been present it is probably safe to say that they would have been picked out by the excavators. We therefore conclude that people were butchering animals at the cave lip, where the light is best and the air freshest. The larger fragments of bone would have remained up-slope more or less where they fell, lying on the surface to disintegrate over time from the effects of weather and trampling. The smaller fragments moved a few metres down-slope, some becoming incorporated within the organic-rich palaeosurfaces within the colluvium of Lithofacies 2C that we found in the excavation of the HP/6 baulk (Figs. 2.48 & 4.14), others coming to rest in hollows on the ground surface of the channel and

being buried (and preserved) within Lithofacies 2. Microscopic examination of surface and fracture-edge modification (Fig. 4.12) found no evidence of water erosion, little evidence of root-etching, and only minimal surface damage from movement and re-working, although the presence of manganese precipitates on some of the bone suggests exposure to moisture-laden sediments, in line with the geomorphological evidence for the formation of Lithofacies 2 described in Chapter 3. In the case of small mammals such as rats, there are several examples of the bones of individual animals occurring together, suggesting postmortem burial *in situ*.

The cut and chop marks noted on several bone fragments from the Hell sequence of deposits is further evidence for the anthropogenic origin of the main vertebrate bone assemblage (see later: Hunting), as is the frequency of burnt bones. The concentrations of the latter reveal distinct patterning rather than random distribution: they are likely to be either the residues of hearths or dumps of burnt material from hearths. It is clear that the vertebrate fauna from the deposit described by the Harrissons as the ‘bone under ash layer’ (Chapter 2) represents a distinct cultural accumulation. Examination of the Harrison Excavation Archive also suggests that this deposit extended south as well as north from the Hell Trench. In 1957 the excavation of the big E/A1 and E/A2 trenches was halted before their westernmost limit because the diggers encountered a large sub-surface rock. The *c.* 3000

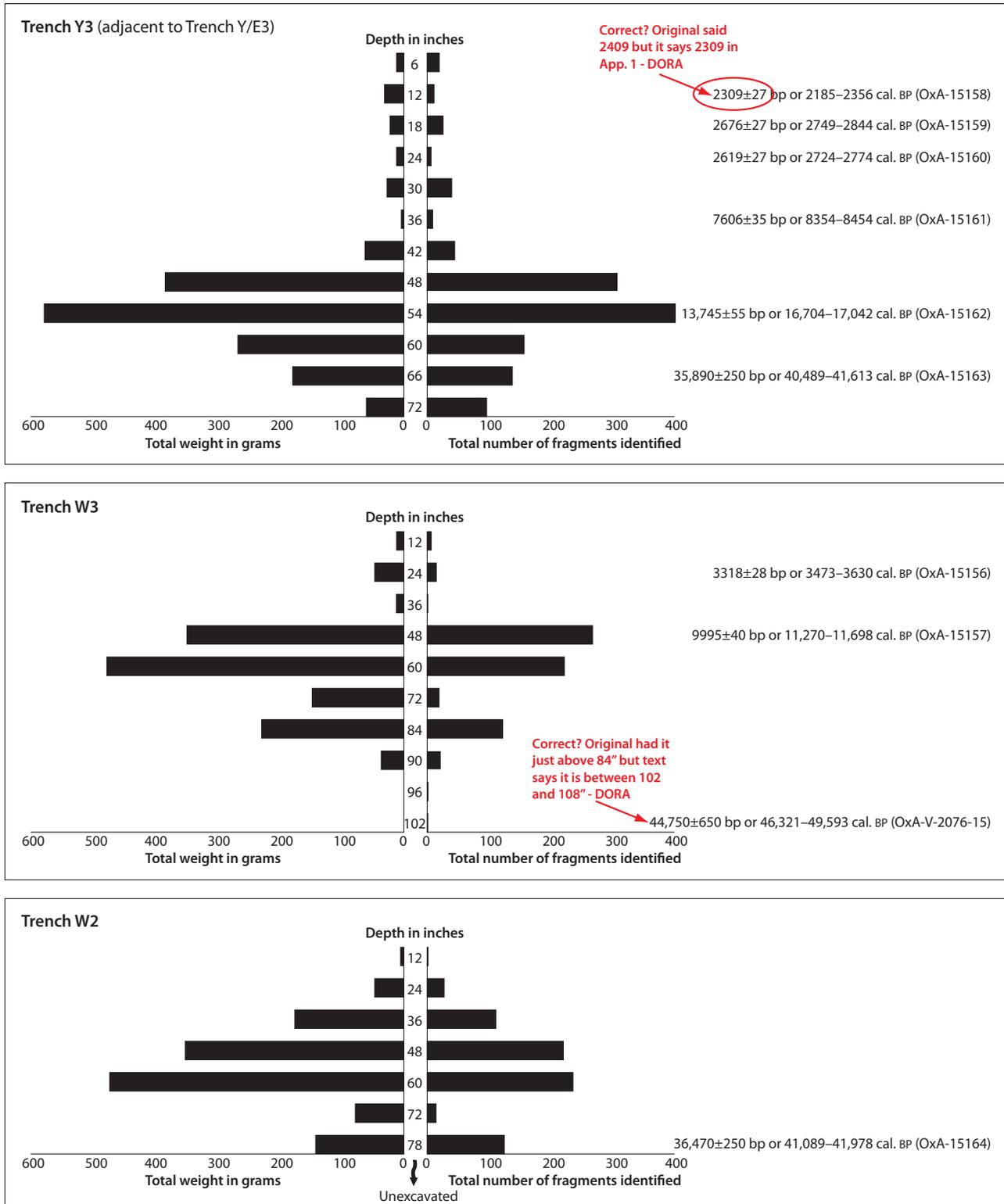


Figure 4.13. The spatio-temporal distribution of animal bones in three of the Harrison trenches between the Hell Trench and the rock overhang, showing the episodic nature of the 'bone under ash layer'. (After Rabett et al. 2006, fig. 5.)

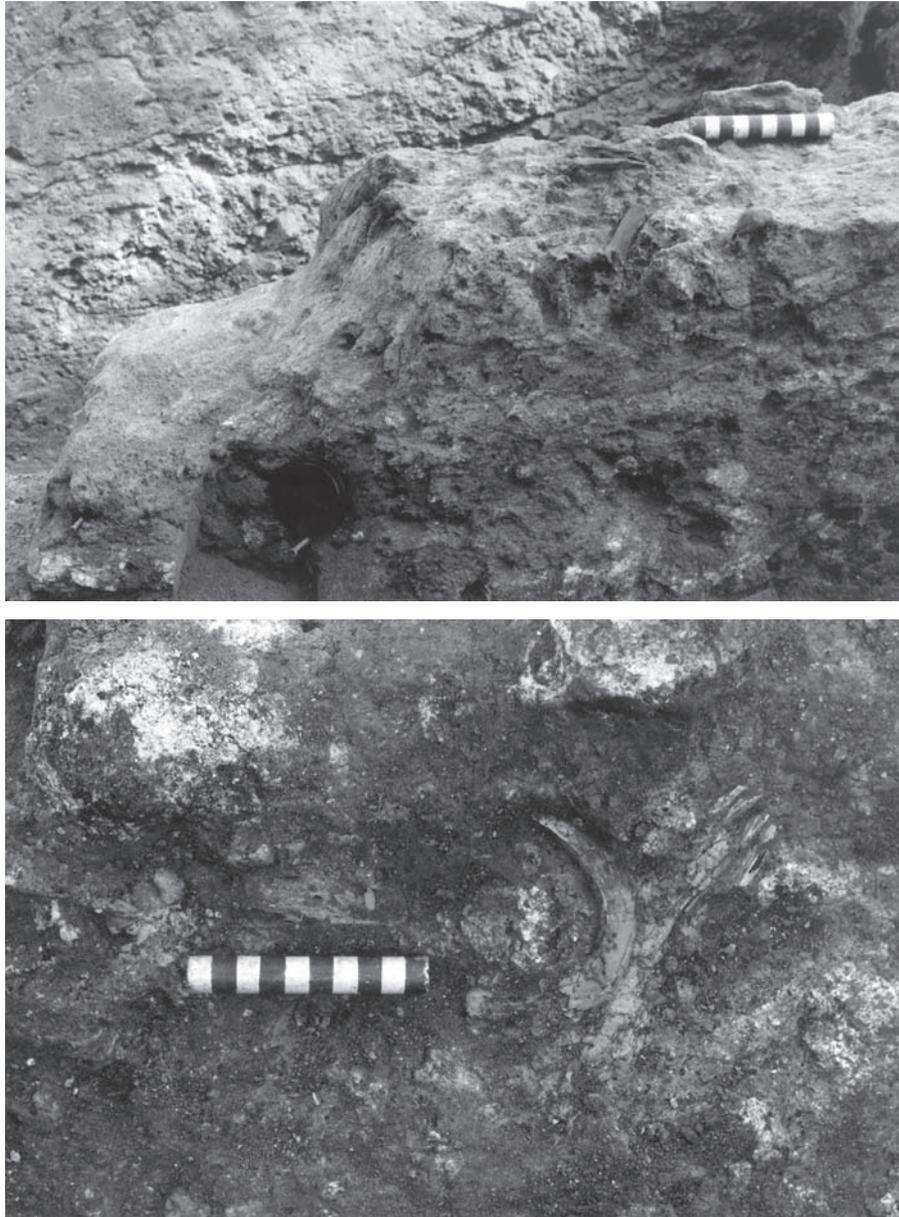


Figure 4.14. Butchered vertebrate fauna associated with ash and charcoal in the palaeosurfaces in the HP/6 fauna: (above) pig limb bones in context 3143, and (below) pig mandible in context 3155. Scales: 10 cm. (Photographs: Graeme Barker.)

fragments of bone recovered from the ‘under rock’ sediments in trenches E/A1 and E/A2 display exactly the same taphonomic features as the fauna from the Hell Trench and under the rock overhang, in terms of evidence of burning, slight abrasion and examples of semi-articulated bones.

The counting and weighing per spit of the bone fragments recovered in selected parts of the Harrison grid indicate that the ‘bone under ash layer’ in fact consisted of a distinct series of phases of accumulation separated by phases of abandonment or smaller-scale

activity (Piper & Rabett 2009b; Fig. 4.13). The deepest and earliest remains were recorded below 72 inches. We were able to date the basal bone concentrations using samples of charcoal in the Harrison Archive, to $36,470 \pm 250$ bp or 41,089–41,978 cal. BP in W2 W/E2 in APP. 1 - DORA (OxA-15164) and $35,890 \pm 250$ bp or 40,489–41,613 cal. BP in Y3 Y/E3 in APP. 1 - DORA (OxA-15163). We also obtained three dates from charcoal taken from the east-facing section of what was the base of Harrison’s 1958–59 W5 trench (102–108 inches) **THIS INFO NOT IN APP. 1 - DORA** under the rock

overhang, of 44,750±650 bp or 46,321–49,593 cal. BP (OxA-V-2076-15), 37,800±320 bp or 41,876–42,911 cal. BP (OxA-V-2076-13) and 36,960±300 bp or 41,345–42,325 cal. BP (OxA-V-2076-14). The range of these dates correlates well with the dates obtained from charcoal in the organic-rich palaeosurfaces that we excavated in the HP/6 baulk **THIS INFO NOT IN APP. 1 - DORA**, which span from 45,900±800 bp or 47,170–[50,000] cal. BP (OxA-V-2057-31) to 34,000±270 bp or 38,000–39,958 cal. BP (Ox-V-2057-28) (Fig. 3.19). The likelihood is that the HP/6 palaeosurfaces (Fig. 4.14) correspond to the activity events which can be discerned within the Harrissons’ ‘bone under ash layer’.

Further evidence of human activity well before the period of deposition of the Deep Skull comes from the sediments under the rock overhang sampled by monoliths A1M to A3M (Section 3.1) discussed above and from monoliths 2/1-8M1 to 2/2-8M3 in the Hell Trench (Fig. 4.4). Thermally-mature material (micro-charcoal) found above 70 cm in Section 3.1 and at the base of the Hell sequence in Zone H-2 **IS THIS H/2? - DORA** might reflect burning inside or outside the cave, because such material disperses widely during burning. The thermally-mature amorphous matter in these assemblages, however, is material which results from the heating of organic matter in sediments underneath fires, so almost certainly indicates local burning, whilst also in Zone H-2 **IS THIS H/2? - DORA** there are spherules produced by burning fatty matter (Hunt *et al.* 2007, 1964). The location of this material is sufficiently far into the cave for plants not to grow, so it is difficult to explain these phenomena except as the result of humanly-initiated fires. Thermally-mature matter indicative of fire-scorching is then found through most of the sequence, like the occurrence of burnt bone. Stone and bone tools from basal Lithofacies 2 and 2C deposits, and from basal Harrison spits, are a further indicator of human presence from c. 50,000 BP (see Technologies, below).

The evidence described above makes it clear that human activity in the West Mouth certainly began at least 10,000 years before the deposition of the Deep Skull. We also excavated a deep sounding on the site of the HP/6 baulk after the latter’s removal, exposing the rock channel underneath the Lithofacies 2

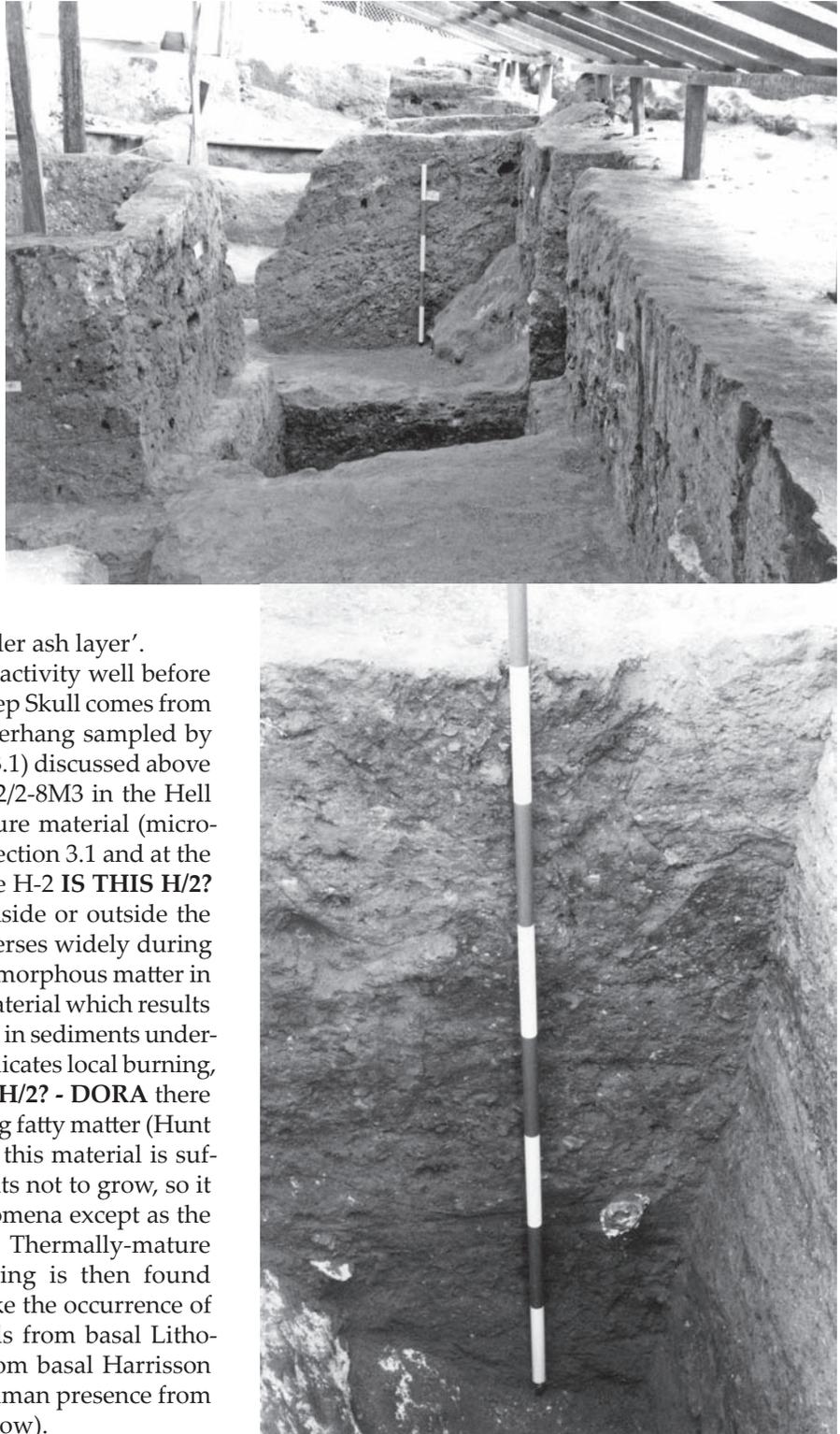


Figure 4.15. The Deep Sounding cut into the floor of the Hell Trench in 2003, after the removal of the HP/6 baulk: (above) looking south and (below) looking north to Section 62.4 (south-facing). Scales in 20 cm intervals. (Photographs: Graeme Barker.)

silts (Fig. 4.15). We did not find charcoal sufficiently preserved for radiocarbon dating in these sediments, though charcoal fragments were evident, but from context 4045 we recovered small quantities of macrovertebrate remains including some burnt fragments, and a flake fragment of jasper, evidence hinting at the possibility of a still earlier human presence at the site.

Technologies [TR, HB, RR]

The assemblage of lithic pieces from the basal spits of the Hell Trench area retained in the Harrison Excavation Archive is comprehensive, with hardened clay lumps, fragments of precipitate, and natural stone clasts all being kept as well as indisputable artefacts. Of the latter, no cores were recovered, the rest of the material consisting of flakes ($n = 27$) and flake fragments ($n = 3$). All of the flakes reported by Harrison and Zuraina Majid from spits below 84 inches, restudied by TR, consist of simple flakes with plain or crushed platforms, many lacking cortex, and without any subsequent reworking. The majority of the flakes have plain platforms ($n = 16$), with cortical ($n = 5$) and crushed platforms ($n = 3$) also present. Two pieces were 'siret'-fractured (split longitudinally along the flaking axis) and there were seven quartzite shatter fragments and a single limestone shatter fragment. Zuraina Majid (1982) suggested the use of 'pilih' technique, a form of block-on-block working that would produce undifferentiated flakes and shatter, though the lack of significant amounts of shatter would argue that direct hard-hammer percussion was being used. (Of course if flaking was taking place in an area unsampled by excavation, the use of pilih technique is possible.) Hard shale ($n = 20$), limestone ($n = 9$) and chert ($n = 1$) comprise the raw materials used. There is no sign of core-edge control such as edge-trimming flakes, core tablets or rejuvenation flakes. None of the pieces exhibits traces of burning or utilization damage, although there are a few pieces with edge snaps characteristic of crushing or trampling.

Our excavation of the HP/6 baulk produced a further sixteen artefacts to add to this assemblage, all of them small flakes and flake fragments with the exception of two small single-platform and flaking-direction flake cores made on quartz pebbles, from contexts 3017 and 3117. There was also an irregular flake core made on a hard limestone fragment from context 3200 and a hard shale shatter fragment from context 3131. The recovery from one of the palaeo-surfaces (context 3131) of five plain platform flakes, two in limestone and three in hard shale, of which two had siret fractures, plus a shatter fragment and a fragment of another limestone flake, suggests that

some knapping activity was taking place on site, involving hand-held hard-hammer direct percussion. If such knapping, like the animal butchery, took place further up the slope of the cave mouth, with these pieces slipping down-slope at a later date, this would explain the lack of any micro-débitage in the sieved samples. Context 3132 yielded three plain platformed tertiary flakes and context 3128 had two weathered tertiary flakes with crushed platforms, all made of limestone. There was a single tertiary flake fragment with a transverse snap made of limestone in context 3154. The small tertiary flake fragment of jasper from context 4045 in our Deep Sounding excavated under the HP/6 baulk has already been mentioned.

Although Zuraina Majid (1982) concluded that, with the exception of quartz, the raw materials used by Late Pleistocene people at Niah — metamorphic sandstone, limestone, chert and jasper — were all non-local to Niah, the nearest source locations being about 50 km away, the main lithic raw materials appear to have been local. Hard limestone and shale were available within the Subis, and quartz pebbles could have been found in local stream channels. There seems little evidence of significant planning and preparation of lithic raw materials: the artefacts appear to represent an expedient use of locally-available stone resources.

The programme of microscopic analysis of use wear and residues by HB included nine flakes from the Harrison excavations ranging in depth from 89 to 111 inches, and two flakes excavated during the NCP work recovered in the vicinity of the Deep Skull (Volume 2, Chapters 16 and 19). The analysis of these artefacts revealed a mixture of uses including scraping and cutting hard materials (wood or bone), working soft plant, and cutting or scraping tree resin (Fig. 4.16). One flake (NCP028, small find 32) contains patches of well-developed glossy polish, and striations consistent with cutting or slicing into hard materials or siliceous plant matter such as rattans or bamboo. Associated with two edges were several very distinct and relatively thick deposits of yellow resin, suggesting that the flake had been used for working resinous wood or pieces of tree resin. Another flake tool (NCP099) in the Harrison Excavation Archive, from trench H/19 at 99–96 inches, also contains pieces of resin, though in this case associated with the fragmentary remains of bird feathers and macerated cellulose tissues, probably tree resin.

The presence of resin raises intriguing questions about its uses at this early time. Was resin being extracted from wood for its uses as a fire-starter, or to illuminate darker sections of the cave? Was it for hafting stone or organic tools? The first strong evidence for the use of hafting to make composite tools at Niah is from the terminal Pleistocene and beginning of the

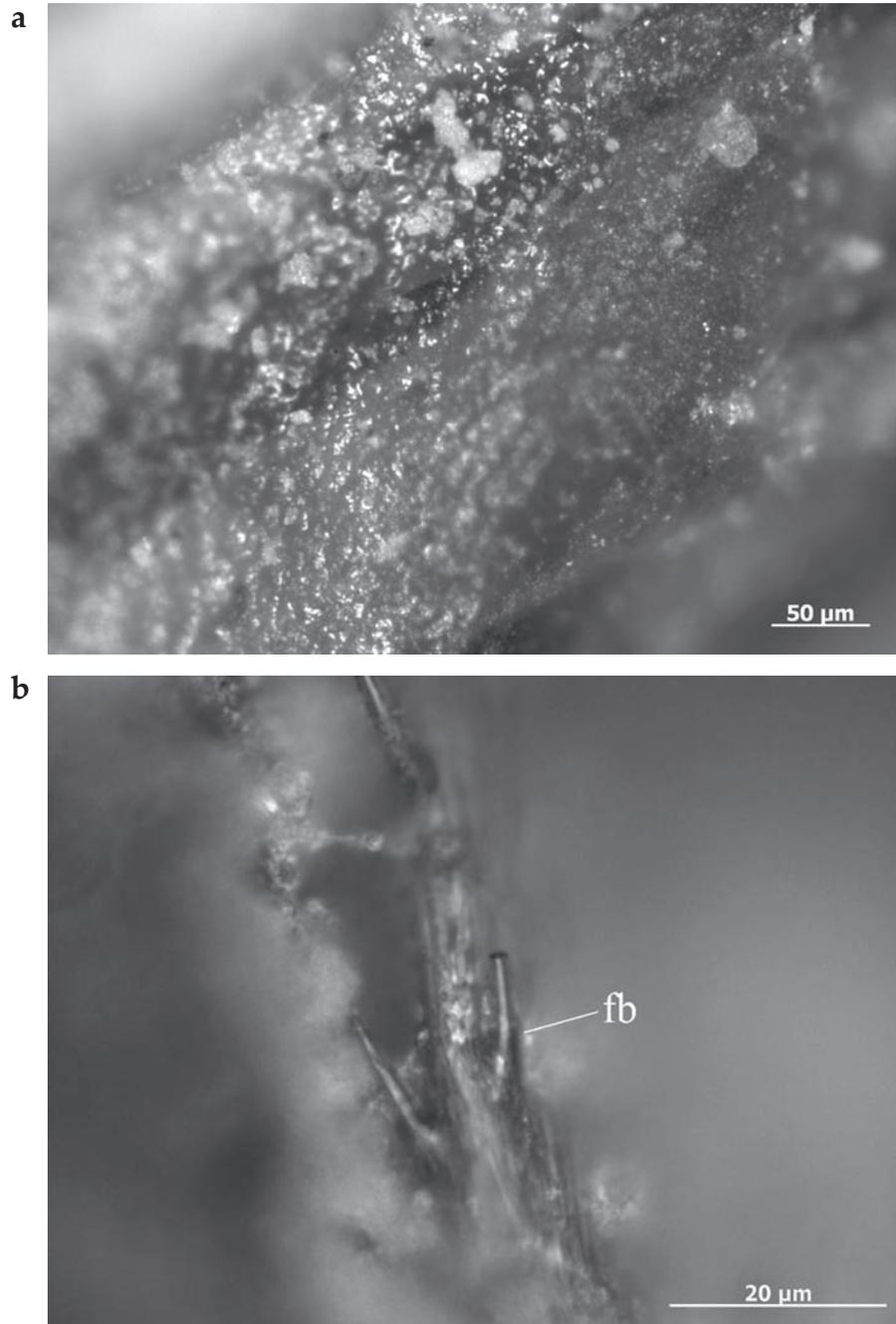


Figure 4.16. Traces of wear and organic residues on stone flakes from basal spits in the West Mouth, showing that the tools were variously used for scraping, cutting and polishing hard materials, and working plant material: (a) flake NCP028, small find 32 [Huw: context?], with patches of well-developed glossy polish at one end and resin on two edges — photograph shows a thick deposit of resin recorded on the distal margin of this flake; (b) NCP099, from trench H/19 99–96 inches, with traces of resin, bird feathers and plant materials. Fragment of bird feather barbule (fb) (Photographs: Huw Barton)

Holocene (Barton *et al.* 2009; and see Chapters 5 and 6), although bone points occur early in the West Mouth sequence (Rabett 2005; and see below). There is now good evidence for the use of hafting mastics at some South African sites by c. 70,000 BP (Lombard 2005).

None of the material from the Harrison Excavation Archive assessed for its use function was unaffected by post-depositional alterations, so there are many caveats relating to the interpretation of this material, whereas the few flakes recovered by the NCP

project were properly curated for microwear studies, so the results on the latter are more reliable. Overall, there is good evidence for the use of stone to work 'hard' materials, that is, materials that have produced extensive areas of glossy polish on the used edges of the stone artefacts. Even when artefacts are relatively pristine and have been collected with care, it is difficult to distinguish the nature of worked materials from use polish, especially on granular stone such as quartzite and metamorphic rock. Nevertheless, the presence of glossy polish on several artefacts is consistent with an interpretation that stone flakes could have been used for the production of organic objects including wooden tools or implements made from rattans and bamboo. The presence of resin, feather barbules, cellulose tissues and starch granules further implies that the range of tasks being undertaken with stone flakes included processing food plants, perhaps bird butchery, and (if the resin and bird feathers represent a related set of tasks) even some form of craftwork. The tools from the deepest occupation levels in the West Mouth, although consisting of unworked and unmodified flakes of quartzite, limestone and metamorphic rock, sometimes show evidence of multiple uses such as working soft plant and wood/bone or bird feathers and resins. The diversity of arboreal taxa, woody forms and palm species identified in the phytolith remains also supports the evidence of the residues that a range of organic materials was fashioned into artefacts. (The evidence for bone-working is described below.)

The lithic material worked at Niah between *c.* 50,000 BP and *c.* 35,000 BP is consistent with the evidence from other archaeological sites in the region occupied at about the same time such as Tabon Cave in Palawan (Fox 1970; 1978) and Lang Rongrien in Thailand (Anderson 1997; 2005). There is nothing other than simple flaking processes to support the associations drawn by Tom Harrisson (1970) with Soan (Indian) or Tampanian (peninsular Malaysian) industries. The Soan as a complex has in fact been questioned: it is based upon surface collections, lacks substantial typological patterning, and is poorly dated (Dennell 2007; Dennell & Rendell 1991; Rendell *et al.* 1989). The 'Tampanian' defined by Walker and Sieveking (1962) from their excavations at Kota Tampan was regarded as a pebble-tool industry, in common with other Southeast Asian industries. The early excavation recovered an undated set of flaked river pebbles and flakes from a river-gravel terrace. More recent work in the vicinity has recovered a more flake-based collection on a palaeolake shore, manufactured using anvils. The site has been dated indirectly to *c.* 70,000 BP (Zuraina Majid 1998; Zuraina Majid & Tjia

1988) and may be the product of *Homo sapiens*, though as yet there is no direct fossil evidence to confirm this. There are a number of questions about the nature of this industry, but it fits into a broader pattern of lithic reduction in the Lenggong Valley at sites with earlier and later dates, as yet with no evidence for an associated hominin. The unpatterned nature of elements of this collection could be seen to resemble that from Niah, but so would most collections of struck lithics, and there is no necessary link between the two industries.

The other category of tools used by the early visitors to the West Mouth that has survived consists of a small collection ($n = 9$) of modified bone fragments, five of them from prepared tools, from spits that can be assigned to the 'bone under ash layer' (Volume 2, Chapter 16). The deepest and likely earliest example of worked bone is a point from trench HR/1 at 120–123 inches (Rabett *et al.* 2006; Fig. 4.17). Like all the other pieces of bone from this occupation phase, this artefact does not appear to have been extensively shaped, but it is clear that attention went into creating a pointed and straight-edged tip. There is a noticeable difference in surface lustre between the point and the base of the piece, as well as very fine longitudinal striations associated with the tip area and front third of the tool, marks that suggest that this implement was used for piercing fine-grained material, such as in the production of basketry. None of the pieces has evidence in terms of shape or wear for its use as an armature of any sort, of the kind found in the Late Pleistocene (Chapter 5) and Early Holocene (Chapter 6), so the use of bone for projectile points at this time can probably be discounted. Three of the artefacts were probably already broken when they were deposited. Two of these show use-striations consistent with rotational or transverse motion, implying that bone tools from this period had a variety of uses, much like the stone flakes.

Pigment use [PP, RR]

A pigmented fragment of geoemydd (hard-shelled turtle) plastron was found during the re-study of the Harrisson fauna, amongst the faunal material from square Y3 beneath the rock overhang, at a depth of 66–72 inches. We obtained AMS dates on charcoal in the Harrisson Excavation Archive from similar depths in adjacent trenches (60–66 inches in Y/E3 and 72–78 inches in W/E2) of, respectively, 35,890±250 bp or 40,489–41,613 BP (OxA-15163) and 36,470±250 bp or 41,089–41,978 BP (OxA-15164). These dates indicate the high probability that the age of the plastron fragment is comparable to that of the Deep Skull. The intentionality behind the colouration is uncertain, though

Ryan - Please supply the original unannotated high-resolution images and indicate on the three top photos where the boxes should be correctly placed - DORA

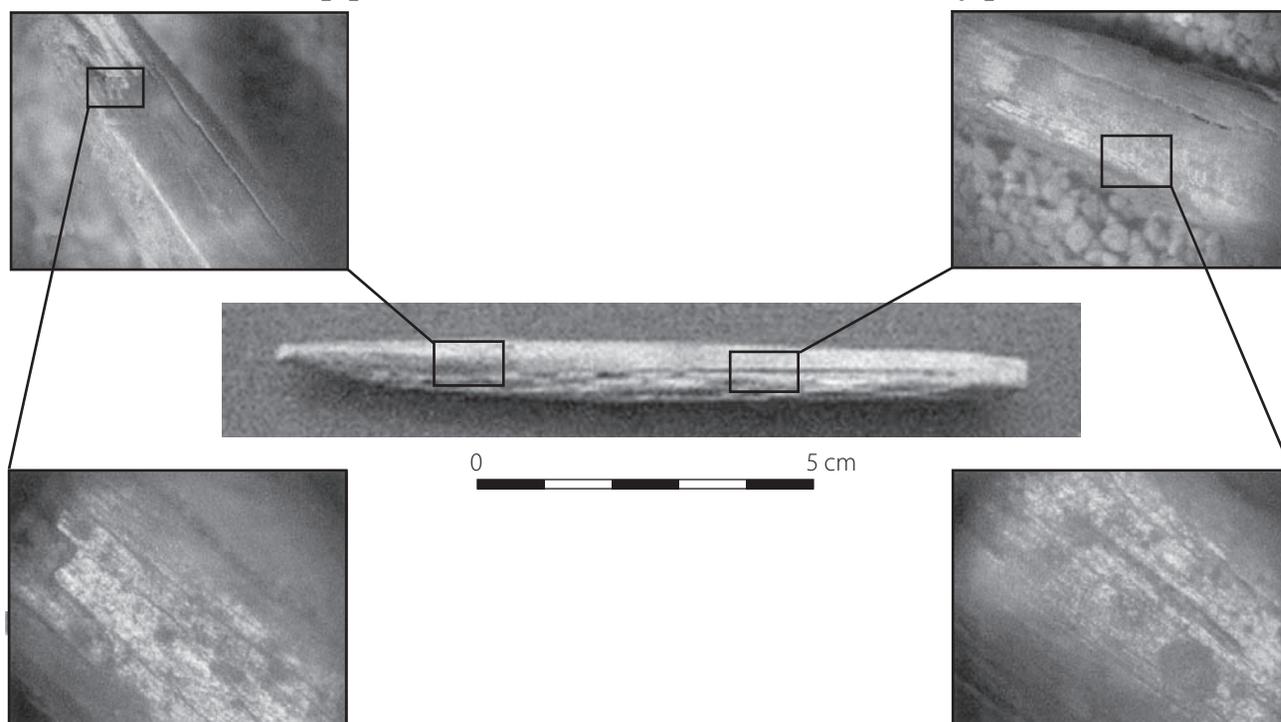


Figure 4.17. A fragment of worked bone from Harrison trench HR/1, at a depth of 120–123 inches, likely to date to c. 45,000 BP, showing evidence of probable use wear consistent with use as an awl. Main scale measures 10 cm. (Photographs: Ryan Rabett, after Rabett et al. 2006, fig. 5.15)

the line between the pigmented and un-pigmented portions is straight and clearly defined and could be taken as a sign of deliberate application. Irrespective, this must be one of the oldest, if not the oldest, pieces of evidence for pigment use by humans in this region. A red ‘wash’ was also found on three fragments of human skull found amongst the vertebrate remains in the Harrison Excavation Archive, again from what we believe was the same stratigraphic level as the Deep Skull. Analysis of one of the fragments using microscopy, energy dispersive microwave analysis, and infra-red spectrophotometry indicates that the wash is probably a tree resin (Pyatt *et al.* 2010), like the red pigment used in the Kain Hitam boat paintings in the first millennium AD (Pyatt *et al.* 2005), rather than, for example, the ochre commonly used by other Palaeolithic societies.

Foraging practices

Hunting [PP, RR]

The macro-vertebrate remains from the Late Pleistocene deposits in the Hell Trench and adjacent occupation zone in the Harrison Excavation Archive were re-studied by PP and RR and colleagues (Piper & Rabett 2009a; Volume 2, Chapter 20). The severity of

fragmentation in the material from the earliest phases of occupation, and the preponderance of extremity bones within the specimens identified to taxa, restricted the methods of quantification that could usefully be applied to the assemblage. This difficulty was compounded by differences in the skeletal structure and element representation between different classes of vertebrates, limiting inter-class comparisons. The following discussion is therefore restricted to the proportions of different taxa represented and the Number of Individual Specimens (NISP) of particular families, genera, or species identified in the material.

In total, almost 60 different taxa from nineteen families of mammals and reptiles and seven of birds were identified in the 2144 identifiable specimens from the ‘bone under ash layer’ deposits in the Hell Trench (Rabett & Barker 2007; Table 4.2). Fish remains were also recovered, including examples of large fresh-water Cyprinids, but these remains are still being studied. Small carnivores only account for (NISP) 1.4 per cent of taxa represented within the entire Hell Trench assemblage, and appear to be absent from the assemblage considered in this chapter, apart from a conjoining astragalus and calcaneus from the common palm civet (*Paradoxurus hermaphrodites*). This lack of representation may have been a

Table 4.2. Identified vertebrate fauna from Hell and associated deposits (E/B2a–e, E/A1 [U/R] and E/A2 [U/R], 72 inches and deeper) in the West Mouth expressed as NISP (number of identifiable fragments) and relative frequency of fragments (%). Fish and micro-mammal fauna are excluded from this table. †Apodidae identification based on the occurrence of whole carpo-metacarpus elements only; all other identifications are made from a range of different skeletal elements.

Family	Taxon	Common name	Hell		E/B2 and E/A [U/R]		Combined values	
			NISP	%	NISP	%	NISP Total	%
Birds								
Accipitridae	Accipitridae sp.	Raptor	2	0.14	1	0.14	3	0.14
	<i>Macheiramphus alcinus</i>	Bathawk	1	0.07	-	-	1	0.05
Apodidae†	<i>Aerodramus maximus</i>	Black-nest swiftlet	24	1.70	-	-	24	1.12
	<i>Aerodramus salanganus</i>	Mossy-nest swiftlet	30	2.13	-	-	30	1.40
	<i>Collocalia esculenta</i>	White-bellied swiftlet	12	0.85	-	-	12	0.56
Bucerotidae	<i>Anorrhinus galeritus</i>	Bushy-crested hornbill	-	-	1	0.14	1	0.05
	<i>Anthracoceros</i> sp.	Pied/black hornbills	1	0.07	-	-	1	0.05
	Bucerotidae sp.	Hornbills	-	-	3	0.41	3	0.14
Corvidae	<i>Cissa chinensis</i>	Green magpie	1	0.07	-	-	1	0.05
	<i>Cissa</i> sp.	Green magpies	2	0.14	-	-	2	0.09
Estrildidae	<i>Lonchura cf. fuscans</i>	Dusky munia	3	0.21	-	-	3	0.14
Phasianidae	<i>Arborophila</i> sp.	Partridge	2	0/14	-	-	2	0.09
	<i>Lophura ignita</i>	Crested fireback	1	0.07	-	-	1	0.05
	<i>Lophura erythrothalma</i>	Crestless fireback	1	0.07	-	-	1	0.05
	<i>Lophura</i> sp.	Gallopheasants	1	0.07	-	-	1	0.05
Strigidae	<i>Strix leptogrammica</i>	Brown wood owl	1	0.07	-	-	1	0.05
Mammals								
Bovidae	<i>Bos</i> spp.	Cattle	6	0.43	4	0.54	10	0.47
Cercopithecidae	Cercopithecidae spp.	Monkeys	152	10.80	22	2.99	174	8.12
	<i>Macaca fascicularis</i>	Long-tailed macaque	7	0.50	-	-	7	0.33
	<i>Macaca nemestrina</i>	Pig-tailed macaque	1	0.07	-	-	1	0.05
	<i>Macaca</i> sp.	Macaques	4	0.28	1	0.14	5	0.23
	<i>Presbytis</i> sp.	Leaf monkeys	28	1.99	1	0.14	29	1.35
Cervidae	<i>Cervus unicolor</i>	Sambar	4	0.28	5	0.68	9	0.42
	<i>Muntiacus</i> sp.	Muntjaks	12	0.85	3	0.41	15	0.70
Felidae	<i>Felis bengalensis</i>	Leopard cat	1	0.07	-	-	1	0.05
	<i>Felis</i> sp.	Cat family	7	0.50	-	-	7	0.33
Hystricidae	Hystricidae spp.	Porcupines	35	2.49	-	-	35	1.63
Manidae	<i>Manis javanica</i>	Pangolin	35	2.49	2	0.27	37	1.73
	<i>Manis</i> cf. <i>palaeojavanica</i>	Giant pangolin	9	0.64	-	-	9	0.42
Mustelidae	Mustelidae spp.	Weasel family	1	0.07	-	0	1	0.05
Pongidae	<i>Pongo pygmaeus</i>	Orangutan	78	5.54	22	2.99	100	4.66
Rhinocerotidae	<i>Dicerorhinus sumatrensis</i>	Sumatran rhinoceros	-	-	1	0.14	1	0.05
Sciuridae	Sciuridae spp.	Squirrels	3	0.21	1	0.14	4	0.19
Suidae	<i>Sus</i> cf. <i>barbatus</i>	Bearded pig	483	34.30	409	55.57	892	41.60
Tapiridae	<i>Tapirus indicus</i>	Tapir	2	0.14	-	-	2	0.09
Tragulidae	<i>Tragulus napu</i>	Greater mouse deer	4	0.57	1	0.14	9	0.42
	<i>Tragulus</i> spp.	Mouse deer	8	0.57	1	0.14	9	0.42
Ursidae	<i>Helarctos malayanus</i>	Sun bear	1	0.07	1	0.14	2	0.09
Viverridae	<i>Arctictis binturong</i>	Bear cat	1	0.007	9	1.22	10	0.47
	<i>Paguma larvata</i>	Masked palm civet	6	0.43	-	-	6	0.28
	<i>Paradoxurus hermaphroditus</i>	Common palm civet	3	0.21	-	-	3	0.14
	Viverridae spp.	Viverrids	5	0.36	1	0.14	6	0.28

Table 4.2. (cont.)

Family	Taxon	Common name	Hell		E/B2 and E/A [U/R]		Combined values	
			NISP	%	NISP	%	NISP Total	%
<i>Reptiles</i>								
Crocodylidae	<i>Crocodyllus cf. porosus</i>	Estuarine crocodile	6	0.43	-	-	6	0.28
Geoemydidae	<i>Cuora ambionensis</i>	Malayan box turtle	1	0.07	-	-	1	0.05
	<i>Cyclemys/Heosemys</i>	Spiny hill/Asian leaf turtle	1	0.07	4	0.54	5	0.23
	<i>Cyclemys dentata</i>	Asian leaf turtle	1	0.07	2	0.27	3	0.14
	Geoemydidae spp.	Hard-shelled turtles	163	11.58	154	20.92	317	14.79
	<i>Notochelys platynota</i>	Malayan flat-shelled turtle	2	0.14	7	0.95	9	0.42
	<i>Orlita borneensis</i>	Malaysian giant turtle	1	0.07	-	0	1	0.05
Pythonidae	<i>Python cf. reticulatus</i>	Reticulated python	9	0.64	1	0.14	10	0.47
Testudinidae	<i>Manouria emys</i>	Asian brown tortoise	2	0.14	-	0	2	0.09
Trionychidae	<i>Amyda cartilaginea/ Pelochelys cantorii</i>	Asian soft-shelled turtle/ Giant soft-shelled turtle	-	-	3	0.41	3	0.14
	<i>Amyda cartilaginea</i>	Asian soft-shelled turtle	2	0.14	2	0.07	4	0.19
	<i>Dogania subplana</i>	Malayan soft-shelled turtle	-	-	8	1.09	8	0.37
	Trionychidae spp.	Soft-shelled turtles	50	3.55	4	0.54	54	2.52
Varanidae	<i>Varanus cf. salvator</i>	Water monitor	2	0.14	-	-	2	0.09
	<i>Varanus</i> spp.	Monitor lizards	190	13.49	63	8.56	253	11.80
Total			1408	100.00	736	100.00	2144	100.00

feature of availability within the local environment, or the consequence of another variable such as prey choice or the landscape around the caves (and the activities of humans within it) just not being attractive to foraging mesocarnivores.

Overall, the combined proportions of taxa by habitat in the basal levels of human occupation in the West Mouth include fauna favouring strictly arboreal habitats such as the orangutan and leaf monkeys (*Presbytis* spp.), accounting for 6.06 per cent ($n = 129$); mixed terrestrial-arboreal fauna, including macaques (*Macaca* sp., but excluding Cercopithecidae), felids (e.g. leopard cat), viverrids (bear cat, masked palm civet, common palm civet), mustelids, ursids (sun bear), hystrecids (porcupine), sciurids (squirrel) and pythonids (reticulated python) (4.60 per cent; $n = 98$); aquatic-terrestrial vertebrates, including estuarine crocodile (*Crocodyllus cf. porosus*), geomydids (turtle), trionychids (soft-shelled turtle), and varanids (water monitor, monitor lizard) (31.28 per cent; $n = 666$); and, especially, fauna with fully terrestrial habitats including the bearded pig (*Sus cf. barbatus*), Asian brown tortoise (*Manouria emys*), Sumatran rhino (*Dicerorhinus sumatrensis*), cervids (sambar, muntjac), manids (pangolin, giant pangolin), and bovids (cattle) (45.80 per cent; $n = 975$) (Figs. 4.18 & 4.19). An important component of the game hunted by the first visitors to the West Mouth was a typically modern rainforest fauna that included orangutan, Malay bear, leaf monkeys, and viverrids, together with the now globally extinct giant pangolin (Cranbrook 2000; Hooijer

1960a; Piper *et al.* 2007a). The faunal list indicates a mosaic of different vegetation types, always including closed-canopy lowland forest. Given the pollen and palynofacies indicators discussed earlier for fluctuations between drier more open (stadial) and wetter more closed rainforest (interstadial) environments in the period c. 50,000–35,000 BP, we need to be mindful that the faunal data are at a loose level of chronological resolution and affected by time-averaging. Nevertheless, given the paucity of true open-ground species in Borneo, the key prey species for the people visiting the Niah Cave, whether in periods of more open or more closed environments, would have been rainforest species, and an essential part of foraging strategies had to be the ability to pursue and kill forest species.

Most traditional foragers observed in the recent past (i.e. unaided by guns or mechanized transport) hunted within a couple of hours' walk from their campsite; when food resources became scarce, it was easier to shift the camp to a new location than to spend more hours each day walking in search of game. On the assumption that the game being butchered in the West Mouth was not being brought there from more than a distance of a few kilometres, the presence of arboreal species in the Niah faunal record clearly indicates that forested conditions existed within easy access of the cave when it was being visited in this period, and that people were capable of hunting game in these habitats. The dominant terrestrial component of the fauna comprises species adapted to forest and forest-edge environments. Most large



Figure 4.18. Some of the species identified in the Pleistocene fauna from the West Mouth. (Adapted from images in Payne & Francis 1998; illustrations by Karen Phillipps; © Courtesy of Caroline Getty.)

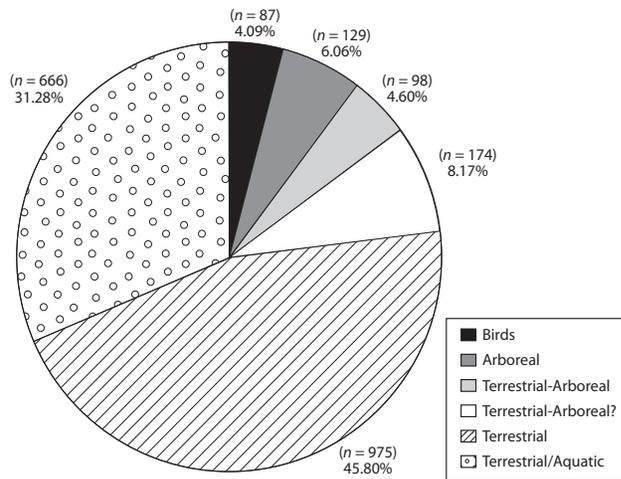


Figure 4.19. Habitat preferences of the game brought back to the West Mouth by human visitors to the site in the period c. 50,000–35,000 BP.

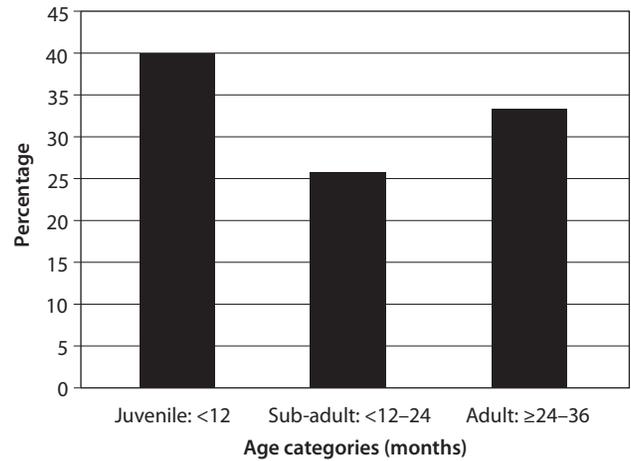


Figure 4.20. Composite population age profile for bearded pig (*Sus barbatus*) remains from human occupation levels in the West Mouth c. 50,000–35,000 BP; the profile is different from that produced by modern hunting practices, perhaps indicative of the use of snares and traps.

terrestrial rainforest fauna are more active at dawn and dusk or during the night (Lekagul & McNeely 1988; Payne & Francis 1998), whereas the majority of larger mixed-habitat terrestrial/arboreal species, such as the leaf monkeys and macaques, and high-canopy arboreal mammals such as orangutan, are more diurnally active (Whitmore 1999). The range of species represented in Table 4.2 therefore implies an ability to deploy technologies that were either tailored to target different prey species according to their particular activity cycle, or could be adapted to do so. The frequency of bones of leaf monkeys and macaques and of orangutan implies that primates constituted an important part of the diet.

The primary species, though, appears to have been pig, on biometric criteria almost certainly the bearded pig (*Sus cf. barbatus*) (Cucchi *et al.* 2009). Skeletal elements of *Sus* are ubiquitous and abundant throughout the NCP contexts and the Harrison spits representing the early human occupation. They include the remains of juvenile, sub-adult, and adult individuals (Fig. 4.20), and (on the basis of tusk form) both males and females. The lack of targeting of particular age groups is unlike modern hunting practices: the Penan foragers of Borneo, for example, equipped with blowpipes and dogs, traditionally target adult or aged pigs (Cranbrook & Labang 2003 NOT IN REFS). The mortality data therefore suggest a non-selective procurement strategy such as trapping or snaring. Though the forests around Niah in the period c. 50,000–35,000 BP were clearly somewhat different in composition to the dipterocarp rainforests

of the Bornean lowlands today, it is possible that the hunters of bearded pigs were able to take advantage of mass migratory and reproductive cycles of the kind known today in response to cyclic gluts in tree fruiting, when local pig populations may increase by a factor of ten in a few months (Curren & Leighton 2000 NOT IN REFS Curran & Leighton 1990?). During these ‘mast fruiting events’ today, hunters encounter groups of adult sows foraging with juveniles and sometimes adult males, the two main groups represented in the Niah fauna, whereas at other times the more usual encounters are with solitary adults and sub-adults (Curran & Leighton 2000 NOT IN REFS 1990?, 116).

The spatial distribution of the pig and primate remains in the Harrison trenches shows clear and statistically significant variation, with a higher percentage of primate bones recovered from the southern (HO and HE) trenches than from the northern (HP and HQ) trenches. However, these differences probably reflect biases caused by the over-deep (to 96 inches) excavation of, and poorer recovery methods applied to, the original E, E/B1 and E/B2 trenches in between (see Chapter 2). There is some evidence that the larger bone fragments of the large ungulates were discarded during the earlier excavations, causing the over-representation of identifiable fragments of small- to intermediate-sized animals in this part of the ‘bone under ash layer’. Fragments of *Sus* sp. are slightly more abundant at 72–96 inches in E/B2(b), at 60–72 inches in E/B2(c), and at 72–96 inches in the deposits under the rock overhang in E/A1 and E/A2 than in the Hell trenches, suggesting that the ‘bone

Table 4.3. Butchered bones identified in the Harrison Excavation Archive from the Hell Trench and associated fauna. The *Varanus* sp. right femur from HS/2 at 120–123 inches and the small ungulate tibia from HR/3 at 126–129 inches are not dated directly, but charcoal from this level in the adjacent trench (HS/3) has provided a date of 41,200±400 bp or 44,242–45,506 bp (OxA-15630). E/B2(b) 72–96 inches has yielded a date of 43,400±700 bp or 45,236–48,355 bp (OxA-15629), but we cannot be certain that the butchered fragment of pig from this large spit was contemporaneous with the dated sample of charcoal, making association tentative only.

Bone ID no.	Trench	Spit	Taxon	Element
HWM-12671	E/B2d	60–72"	Large mammal	Cervical vertebra
HWM-7675	E/A1[U/R]	72–96"	Large mammal	Mandibular condyle
HWM-6517	HP/8b	84–87"	Macro	Rib fragment
HWM-4962	HE/11	102–105"	Macro	Rib fragment
HWM-10035	HO/8	96–102"	<i>Pongo pygmaeus</i>	Orbital fragment
HWM-9709	HE/8	102–105"	<i>Sus</i> sp.	Thoracic spinous process
HWM-9711	HE/10	102–105"	<i>Sus</i> sp.	Thoracic body (joins to above)
HWM-10680	E/B3b	60–66"	<i>Felis</i> sp.	Proximal humerus
HWM-7679	E/A1[U/R]	72–96"	Primate	Humeral shaft fragment
HWM-9738	HE/4	102–105"	<i>Presbytis</i> sp.	Distal humerus
HWM-12070	E/B2b	72–96"	<i>Sus</i> sp.	Proximal radius fragment
HWM-7445	E/A1[U/R]	72–96"	Large mammal	Olecranon process
HWM-22818	E/A2 [U/R]	60–72"	<i>Sus</i> sp.	Pubis fragment
HWM-19517	HO/1	96–99"	Cercopithecidae	Proximal femur
HWM-9541	HO/2	96–99"	Cercopithecidae	Femoral shaft
HWM-10674	HO/6	96–102"	Cercopithecidae	Distal femur
HWM-4368	HS/2	120–123"	<i>Varanus</i> sp.	Whole femur
HWM-9792	HO/8	96–102"	<i>Manis javanica</i>	Proximal tibia shaft fragment
HWM-9737	HR/3	126–129"	Small ungulate	Proximal tibia
HWM-4908	E/B2e	60–72"	<i>Sus</i> sp.	Calcaneus
HWM-11430	E/B2d	60–72"	<i>Arctictis binturong</i>	Calcaneus
HWM-9746	HO/8	96–102"	<i>Sus</i> sp.	Proximal metatarsal II
HWM-9540	HR/1	102–105"	<i>Pongo pygmaeus</i>	Proximal metapodial
HWM-4984	HE/11	123–126"	Cercopithecidae	Phalanx
HWM-7687	E/A1[U/R]	72–96"	Large mammal	Long bone fragment
HWM-7676	E/A1[U/R]	72–96"	Macro	Indeterminate fragment
HWM-11583	HP/7a	87–90"	Macro	Indeterminate fragment
HWM-10029	HP/2	96–99"	<i>Sus</i> sp.	Indeterminate fragment
HWM-9816	HO/8	96–102"	Macro	Indeterminate fragment
HWM-10678	HO/8	96–102"	Macro	Indeterminate fragment

under ash layer' was partially truncated before being recognized, after which the material within it was collected carefully. The possibility exists, though, that the localized bone accumulations of particular taxa that we can observe may in part relate to partial carcasses being deposited directly into the channel. For example, the HQ sequence of Harrison trenches produced 105 pig bones compared with just seventeen monkey fragments, and the 87–108 inches spits in HQ/2A and HQ/2B produced 24 pig bones representing at least two individuals, including a tiny juvenile, compared with 37 pig and 68 monkey bones from the HO series. HO/17 included the partial skeleton of a leaf monkey.

In total, fifteen examples of cut and chop marks were recorded on bone fragments from the material deriving from the 'bone under ash layer' (Table 4.3; Fig. 4.21). The butchered taxa include pig (*Sus barbutus*), pangolin (*Manis javanica*), binturong (*Arctictis*

binturong), monkeys (Cercopithecidae) and monitor lizard (*Varanus* cf. *salvator*). Chop marks on the surface of conjoining fragments of a pig thoracic dorsal spine (bone fragment id.: HWM-9709 and HWM-9715 in our faunal data base) suggest that meat and muscle were being removed from the vertebral column, an act of secondary butchery (removing the tenderloin) that presumably took place on site. Cut marks on the ventral surfaces of the neck and anterior regions beneath the lesser trochanter of a monkey femur (HWM-19517) were presumably caused by cutting through the muscles that attached it to the pelvis. Cut marks on the posterior surface of the distal end of another femur (HWM-10674), just above the lateral condyle and to the medial side of the popliteal fossa, are an indication of the femur being disarticulated from the tibia, the lower leg bone. Transverse cut marks on a humerus of a leaf monkey (HWM-9738) on or close to the proxi-

Ryan - Please supply the original unannotated high-resolution images - DORA

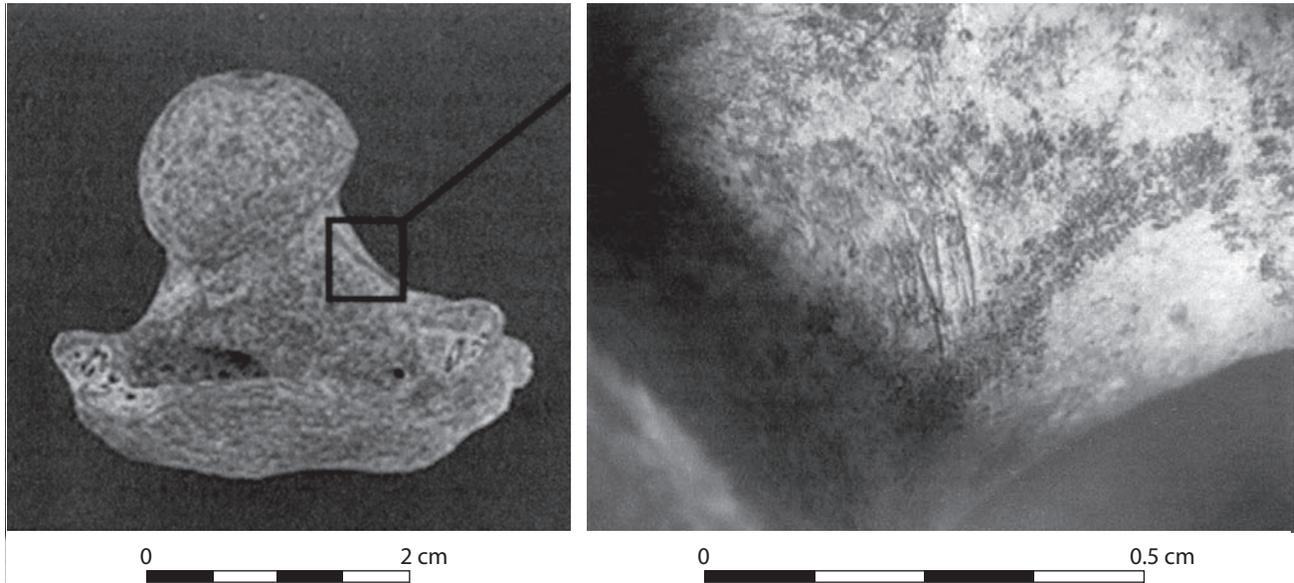


Figure 4.21. Traces of butchery (multiple transverse cut-marks immediately beneath the femoral head) to a proximal monkey (*Cercopithecidae*) femur recovered from the c. 50,000–35,000 BP deposits (HO/1 90–96 inches) in the Hell Trench. Scale: 10 cm. (Photographs: Ryan Rabett)

mal surfaces of the medial side of the supracondylar crest indicate the severance of the upper from the lower arm. Cut marks on the antero-volar aspect of a calcaneus (ankle bone) of a binturong imply that the whole foot was cut from the lower leg. These types of butchery suggest that the first inhabitants of the West Mouth were sometimes carefully dismembering intermediate-sized animals, in particular the carcasses of monkeys, probably as part of food preparation at the camp rather than for the purposes of cutting carcasses into lighter and more manageable ‘packages’ at the location of the kills. The careful butchery practices evidenced in this material, together with the presence of bone implements, indicate that habitual techniques and an appreciation of working animal bone have a deep antiquity at Niah (Volume 2, Chapter 20).

Gathering molluscs [KS]

The focused gathering of molluscs for subsistence has traditionally been seen as a Holocene innovation (Binford 1968; Waselkov 1987), but there is substantial evidence worldwide that this is not a pattern that holds true everywhere (e.g. Gosden & Robertson 1991; Steele & Klein 2008; Szabó *et al.* 2007). Molluscan remains are certainly extremely numerous in Late Pleistocene and Early Holocene contexts at Niah, but they are also a minor but consistent part of the earliest deposits. What follows is a summary of results and observations relating to the material from the basal spits of the Hell Trench and the spits below 84 inches

under the rock overhang. The details of methodologies, identification, and research context and agenda are presented in Volume 2, Chapter 21.

Unfortunately most of the shell material excavated by the Harrissons in the West Mouth was discarded, but their meticulous quantifications of the data survive, together with occasional samples of specimens deemed worthy of retention. As Tom Harrison could not identify species confidently himself, he set up a reference collection of different ‘species’, with each recognized taxon being allotted a unique identity number, the numbers then being used as the basis for quantification. Detailed study of the ‘Shell Books’ in the Harrison Excavation Archive and of the surviving material has enabled nearly all ‘numbers’ to be matched to species, or to groups of species (Volume 2, Chapter 21). To this material can be added the small amount of shell from the early occupation layers obtained from the NCP excavation of the HP/6 baulk (contexts 3138, 3128 and 3130). Initial sorting of this material was carried out at the University of Leicester by Jonathan Shimmin, and Sarah Mount analysed a sample of terrestrial micro-snails.

In general, the shells from the deepest cultural layers at Niah are poorly preserved. Harrison noted that, while shells could be seen *in situ* during excavation, they crumbled to powder when touched or in the sieve (T. Harrison 1957b, 133). However, some zones of the deposit seem to have favoured preservation, as even some small fragile terrestrial snails have

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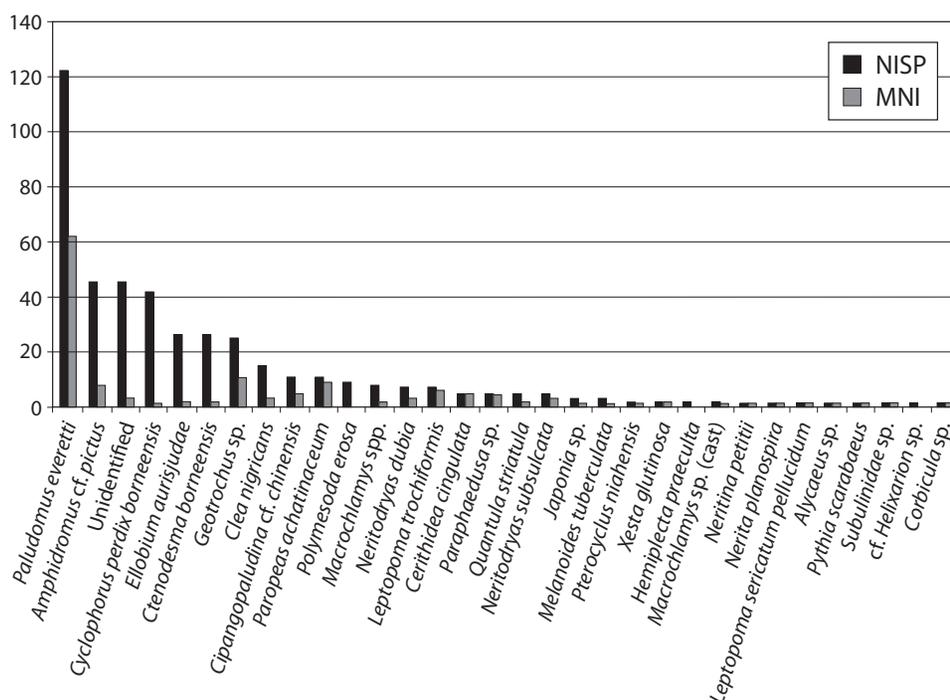


Figure 4.22. Levels of fragmentation of the aquatic and terrestrial molluscan remains from the Hell Trench deposits. NISP = number of identifiable fragments; MNI = minimum number of individuals. (Source: Katherine Szabó.)

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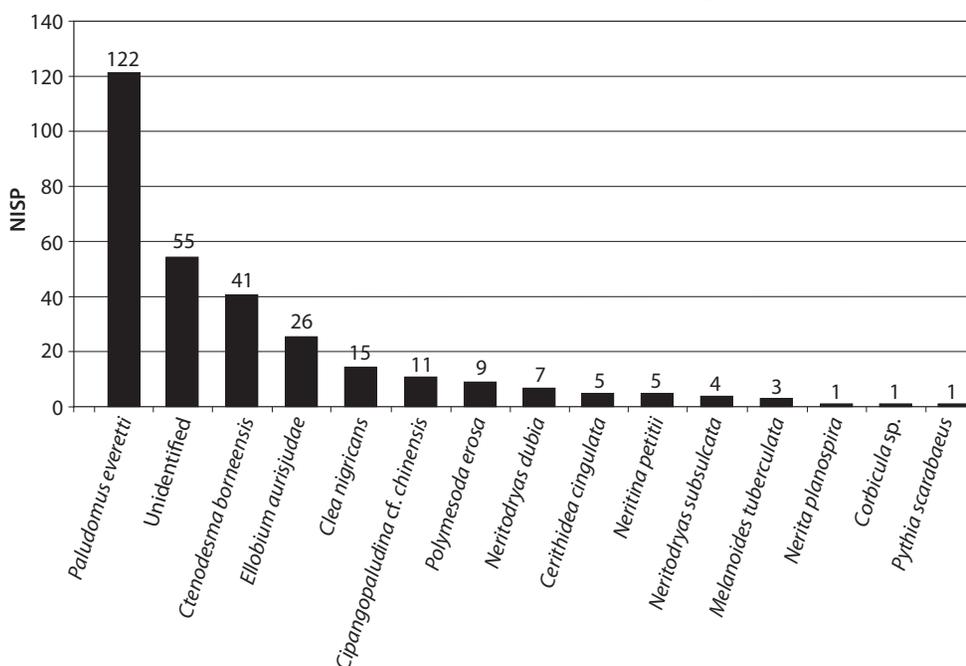


Figure 4.23. The combined fragment count (NISP) of aquatic molluscan remains recovered from the lowest Harrison spits and NCP stratigraphic contexts. Despite being generally considered a terrestrial snail, *Pythia scarabaeus* is included as it is associated with coastal habitats and vegetation rather than the lowland tropical forest vegetation typical of the Niah environs. (Source: Katherine Szabó.)

Table 4.4. The aquatic molluscan species identified within the c. 50,000–35,000 BP sediments in the West Mouth of Niah Great Cave, and their habitat associations: *brackish-water species generally found in association with mangroves; **species of more ambiguous association, often termed as freshwater, but frequently or dominantly found in close proximity to the coast or in strongly tidal reaches of watercourses.

Class	Family	Species	NISP	Habitat
Gastropoda	Neritidae	** <i>Neritina petiti</i>	5	In and around fresh water on hard substrates
		** <i>Neritodryas dubia</i>	7	In and around fresh water on hard substrates; also on riverbank vegetation
		** <i>Neritodryas subsulcata</i>	4	In and around fresh water on hard substrates; also on riverbank vegetation
		* <i>Nerita planospira</i>	1	On and around mangrove trees; coastal
	Viviparidae	<i>Cipangopaludina</i> cf. <i>chinensis</i>	11	Standing/ephemeral fresh water; buried in mud
	Cerithiidae	* <i>Cerithidea cingulata</i>	5	On and around mangrove trees; coastal
	Thiaridae	** <i>Melanoides tuberculata</i>	3	In and around fresh water on hard substrates
		<i>Paludomus everetti</i>	122	In and around fresh water on hard substrates
	Buccinidae	<i>Clea nigricans</i>	15	In and around fresh water on hard substrates
	Ellobiidae	* <i>Ellobium aurisjudae</i>	26	On and around mangrove trees; coastal
* <i>Pythia scarabaeus</i>		1	On and around coastal vegetation (esp. <i>Pandanus</i>); coastal	
Bivalvia	Unionidae	<i>Ctenodesma borneensis</i>	41	Fresh water; buried in soft-bottom sediments
	Corbiculidae	* <i>Polymesoda erosa</i>	9	Brackish water; buried in soft-bottom sediments
		<i>Corbicula</i> sp.	1	Fresh water; buried in soft-bottom sediments

survived in sections of the Hell deposits to depths of c. 100 inches and sometimes deeper. Virtually all of the molluscan remains from the NCP investigations are burnt, as are almost half of the fragments from the extent Harrisson sample, especially from under the rock overhang in Area A. Most unburnt specimens have a chalky texture, indicating the decay of the organic component of the shell and a loss of structural integrity, suggesting that burning has favoured survival. The material from both the Harrisson and NCP excavations is also highly fragmented: in an unfragmented assemblage, the ratio of the Minimum Number of Individuals (MNI) to the Number of Identifiable Specimens of gastropods should be 1:1, and of bivalves should be 1:2, but the NISP fragment counts for the Hell material are far in excess of MNI values, with some species such as the bivalve *Polymesoda erosa* having no minimum number value at all due to the complete absence of hinges from the assemblages (Fig. 4.22). Only small to very small terrestrial snail species such as *Paropeas achatinaceum* and *Leptopoma trochiformis* have largely escaped heavy fragmentation, their preservation suggesting that fragmentation is due to mechanical rather than chemical processes.

The earliest molluscan remains at Niah fall into two broad ecological categories: aquatic molluscs (freshwater and brackish-water) and terrestrial snails. The former unequivocally represent subsistence refuse carried into the cave; the latter, self-introduced into the cave deposits, were discussed earlier (p. XX) in terms of their information about the cave-entrance environment at the time of the first human visitors. Few of the freshwater or brackish-water species have overlapping tolerances with regards to salinity, so two

distinct aquatic environments were being harvested (Table 4.4). Whether the latter represents two contemporary environments being targeted simultaneously, or environmental change with attendant changes in gathering patterns now masked by time-averaging, is difficult to answer: the Harrisson samples were excavated in too coarse a manner to distinguish stratigraphically between these possibilities. In the case of the NCP samples, however, whilst they are very small ($n = 35$ NISP), shells from different contexts are clearly assignable to either a 'fresh' or 'brackish' category: contexts 3128 and 3130 have only freshwater shells (dominated by the mussel *Ctenodesma borneensis*) and terrestrial shells, whereas context 3138 has four fragments of the brackish-water *Neritina petiti* and no freshwater or terrestrial molluscs, suggesting in the latter case an increased accessibility of brackish water. This evidence for repeated fluctuations in the adjacency to the Niah Caves of saltwater environments correlates with the other palaeoenvironmental indicators discussed earlier.

The freshwater shell component of the assemblage is small but revealing about the range of aquatic environments exploited by the human groups using the Niah Caves in the period c. 50,000–35,000 BP. The gastropod *Paludomus everetti* is dominant, supplemented by the freshwater mussel *Ctenodesma borneensis* and the scavenging gastropod *Clea nigricans* (Fig. 4.23). These three species indicate the presence of clear, relatively fast-flowing, freshwater environments in the vicinity of the West Mouth. The genus *Paludomus* is saline-intolerant, preferring swiftly-flowing streams (Brown & Gerlach 1991, 478; Sarasin & Sarasin 1908, 53; Starmühlner 1986). *C. borneensis* is a member of

Table 4.5. Plant remains identified within the c. 50,000–35,000 BP sediments in the West Mouth of Niah Great Cave. Status: wi = wild; f = feral; d = domesticated. † Recovered by Majid (1982).

Family	Species	Common names	Status	Condition
Aracaceae (palms)	<i>Caryota mitis/Eugeissona utilis</i>	Clustering fishtail palm/Hill sago palm	wi	starch granules
	<i>Calamus</i> spp†.	Rattan/rotan	wi	charred nut fragments
Araceae (aroids)	<i>Alocasia longiloba/Cyrtosperma merkusii</i>	-/Swamp taro	wi/f	starch granules
Dioscoreaceae (yams)	<i>Dioscorea alata</i>	Greater yam	d	starch granules
Elaeocarpaceae	<i>Elaeocarpus</i> sp. (<i>stipularis</i>)	'Kusap'	wi	charred nut fragments
cf. Fabaceae (legumes)			wi	charred seeds
Flacourtiaceae	<i>Pangium edule</i> †			
Unclassified fragments	Nut exocarp fragments			charred nut fragments
	Fruit fragments			charred fruit fragments
	Parenchyma			charred parenchyma

the large Unionidae freshwater mussel family, found in lake and river bottoms just below the surface (Dillon 2000, 2). The 'cosmopolitan' gastropod *Melanoides tuberculata* can be found in a wide range of freshwater habitats, from flowing streams to stagnant ponds. *Cipangopaludina* cf. *chinensis*, on the other hand, is associated with rather slow-moving waterways or stagnant ponds and paddy fields (Chiu *et al.* 2002).

The brackish-water component is dominated by *Ellobium aurisjudae*, followed by the large heavy bivalve *Polymesoda erosa*, and the mangrove gastropods *Cerithidea cingulata* and *Nerita planospira*. All are strongly associated today with mangrove areas in Sarawak and elsewhere, but within these they are variously found in discrete locales (Ashton *et al.* 2003; Sri-anoon *et al.* 2005). *Ellobium aurisjudae* and *Cerithidea* spp. prefer mangrove habitats, where they are found in the trees themselves, or on the mud and prop-roots within mangrove forests when the tide is out and the mud exposed (G.M. Barker 2001, 57; MacKinnon *et al.* 1997, 108–9; Vannini *et al.* 2006). *Polymesoda erosa* lives buried in estuarine sediment and can tolerate a wide range of salinities (Modasir 2000; Morton 1976; Radley & Barker 1998). The terrestrial gastropod *Pythia scarabaeus* is found in association with coastal vegetation, especially mangrove areas (Ellison *et al.* 1999), and is included in this brackish category. *Neritina petiti* tends to be considered a freshwater species (e.g. Haynes 2001), but its clear association with other brackish-water members of the Neritidae throughout the Niah Caves deposits raises questions as to its salinity-tolerance parameters. Other species within the Neritidae identified in the Hell Trench assemblage are *Neritodryas dubia* and *Neritodryas subsulcata*. Members of the genus *Neritodryas* are considered to be virtually arboreal, living amongst the foliage of mangroves and *Nypa* palms (Abbot 1991, 24; Morton 1967, 173).

The range and diversity of the fresh- and brackish-water molluscs represented in the c. 50,000–

35,000 BP material indicate that these food sources were being collected not just in rivers, streams and ponds but also from riverbank foliage and rocks, mangrove, and associated stands of *Nypa* palm. While some of these species, such as those associated with riverbank and estuarine vegetation, are visible and can perhaps be collected opportunistically, locating buried freshwater mussels and *Polymesoda erosa* shells required knowledge of their likely presence in particular habitats. Gathering freshwater mussels generally requires wading in the water and locating specimens with the hands or feet (Burrows 1940; Cummings & Bogan 2006, 320–21). Clearly the first occupants of the West Mouth had knowledge of a range of aquatic habitats, and of the fauna present within these even if not immediately visible. In short, the molluscan evidence demonstrates an understanding of the landscape and a degree of intentionality and targeting in this part of the foraging strategy, rather than simply opportunistic gathering.

Gathering plants [HB, LK, VP]

Despite the problems of preservation relating to plant remains compared with animal bones and shells, which for decades have made our knowledge of Pleistocene plant gathering rudimentary, the Niah excavations have provided quite remarkable evidence for plant gathering in the form of starch grains (studied by HB), macro-remains such as nuts and parenchyma or plant tissues (studied by VP), and phytoliths (studied by LK) (Table 4.5). Their detailed methodologies, sampling procedures, and results are described in Volume 2, Chapters 8 and 19.

Starch grains (Fig. 4.24) have been recovered from deposits dating from both before and after the deposition of the Deep Skull. Palm (*Eugeissona utilis* and/or *Caryota mitis*) starch occurs in deposits dated to c. 50,000/45,000 BP, and evidence of yams (*Dioscorea* sp.) appears slightly later. Aroid (*Alocasia* sp.) starches are present in the upper part of the Hell

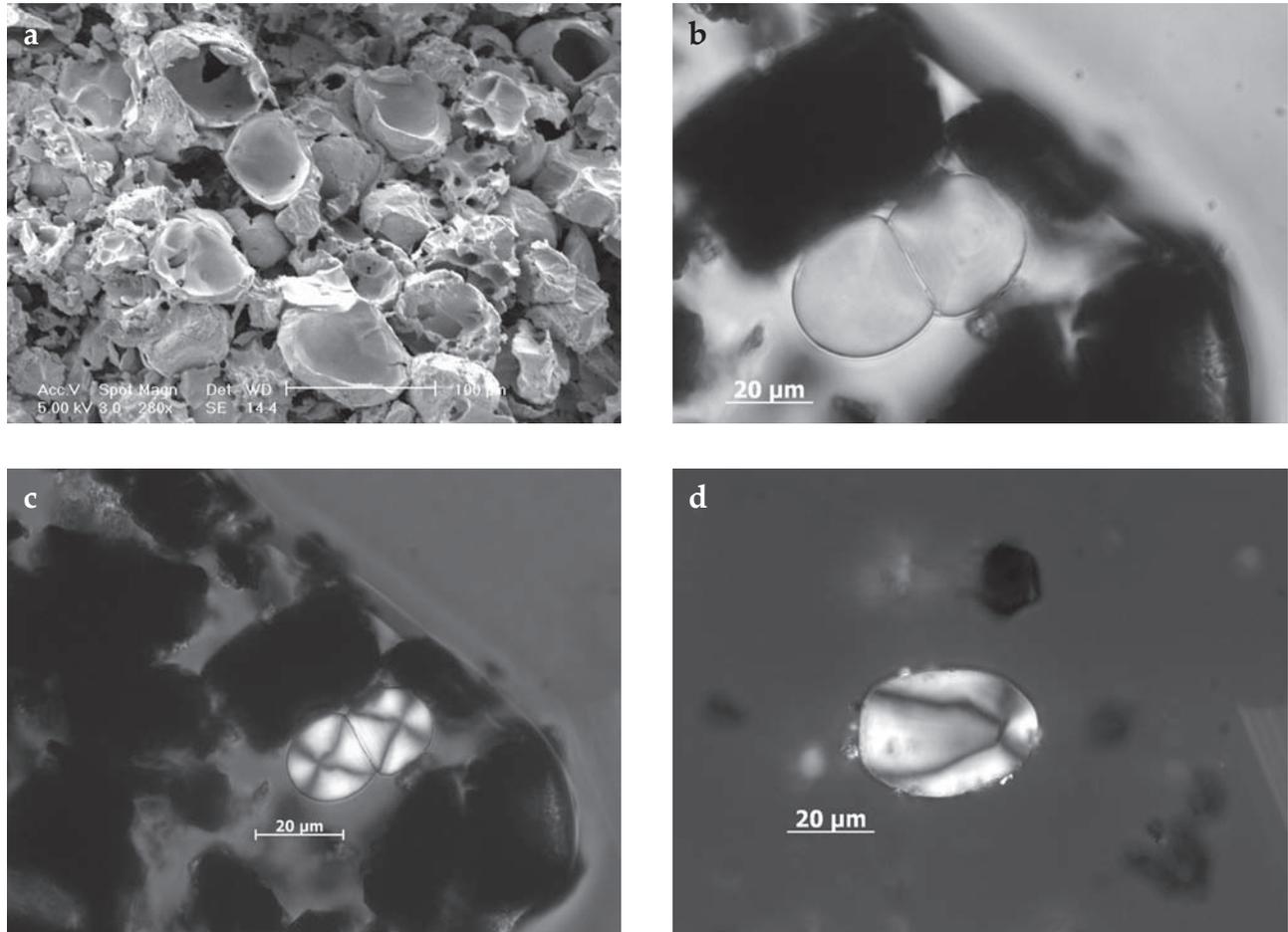


Figure 4.24. Starch granules from sediments in the West Mouth: (a) SEM micrograph of parenchyma tissues of *Colocasia elim esculenta*, context 1020, Area A, 23,086–23,859 cal. BP (OxA-11550); (b) starch granules from *Alocasia longiloba*, context 3129, HP/6 baulk; (c) previous image in cross-polarized light showing birefringence and extinction cross typical of starch granules; (d) starch granule of *Dioscorea* sp. (poss. *Dioscorea alata*), context 3137, HP/6 baulk, cross-polarized light showing birefringence and extinction cross. (Micrograph (a): Victor Paz; starch photographs (b–c): Huw Barton.)

stratigraphic sequence and so post-date c. 40,000 BP, but probably predate the impact of Lithofacies 3 c. 35,000 BP. Some of the aroid starch grains ($n = 16$, 44 per cent of those identified from these deposits), such as those from *Alocasia* spp. and *Alocasia longiloba*, although a plant that contains a known irritant (its Iban name *birrah* refers to its itchy nature), are unlikely to have been transported into the cave other than by people. Further work is required on establishing whether these aroids were definitely exploited by humans at this early stage, but the evidence for the use of palms and yams is clearer. It is likely that humans were foraging for the latter foods from the earliest occupation at the West Mouth: grains of palm starch from ‘sago’ species (that is, palms with starchy edible pith) are present in sediments and on residues

attached to tools from layers dating before 35,000 BP (Fig. 4.16), as are palm phytoliths. The presence of yam in the lower occupation levels of the West Mouth is more tenuous given that only two starch granules (11 per cent) of *Dioscorea* spp. were recovered here (Barton 2005; Barton & Paz 2007). Yam starch is more frequent in the Late Pleistocene, when the use of yams is further supported by the presence of parenchyma tissue from their tubers (Paz 2001, 2005; and see Chapter 5). Starch is also present on one tool (NCP027) from the HP/6 baulk (context 3154), but it is of a type as yet unidentified from current reference materials.

The deep layers in the Hell Trench also contained preserved, charred or mineralized macro-remains of other plants, including fragments of the toxic nut *Pangium edule* recovered from layers below 100 inches

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down to 111–114 inches (Zuraina Majid 1982), so conceivably older than 35,000 BP. Flotation of samples from the Deep Sounding excavated under the HP/6 baulk in the Hell Trench recovered seven nut fragments (from context 4006) that were very similar to reference examples of *Canarium* spp. (Paz & Carlos 2007). The material is clearly old and not well preserved, but implies that from an early date in the use of the West Mouth people were foraging in the forest for edible nuts, and prepared to exploit species that were highly toxic.

The presence in deposits of such antiquity of nut species containing an extremely poisonous compound, and of aroids currently avoided by people in the Borneo rainforests because of their irritating itchiness, is clearly noteworthy. In fact, the frequency of such species within the rainforest was one of the components of the argument that foragers could not have occupied rainforest on a permanent basis (e.g. Bailey *et al.* 1989). Traditional treatments to remove toxins or irritating compounds from such plants have generally involved prolonged boiling, washing and/or soaking. The evidence for the gathering and effective processing of poisonous plants by human groups using the Niah Caves increases significantly in the Late Pleistocene (Chapter 5) and Early Holocene (Chapter 6).

On the evidence of starch granules, phytoliths and tool residues, palms appear to have been particularly important plants for the first human groups using the West Mouth. The phytolith assemblage from context 3150 in the HP/6 baulk included a high proportion (about seven per cent) that is consistent with *Cocos* sp. (coconut) and six per cent likely to be *Caryota* sp. (Fig. 4.25). The presence of *Caryota* palm is important here, as starches consistent with *Caryota* spp. or *Eugeissona* spp. (sago) were also common ($n = 8$, 22 per cent of total Hell Trench sample) in context 3158, slightly below context 3150. Today and in the recent ethnographic past, tree palms such as sago represent and have represented an extremely important resource for food (the pith and fruit of some species, and the shoots of many species), materials for house construction (especially palm fronds for roofing), for clothing, and especially as a raw material for the manufacture of many tools and for craft activities. Palms are a diverse family, and include the highly utilized group of slender climbing palms otherwise referred to as 'rattan' or 'rotan'. These plants are frequently used in the manufacture of matting, basketry, clothing, decoration, and as a tie or binding. Some species may also be exploited as food, especially for their new shoots, and in some cases the fruits are edible. Some of the palm phyto-

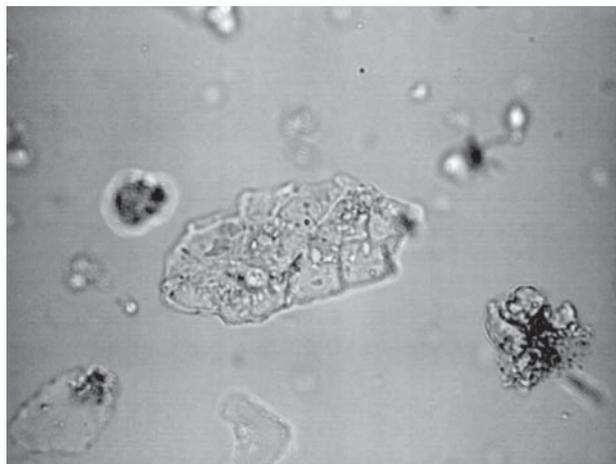


Figure 4.25. Phytolith of *Caryota* sp. palm from sediments in the HP/6 baulk. (Photograph: Lisa Kealhofer CORRECT??) [what magnification?]

liths in context 3150 of the HP/6 baulk might come from such plants.

Phytoliths of bamboo, a plant that we might expect to have been present for the production of tools given the heavy use-wear polish discussed earlier, are present but rare in these lower levels. The range of taxa represented in the phytolith sample provides additional evidence for broad-spectrum plant use, with tree fruits such as Annonaceae and Moraceae, and sources of plant fibre such as palm, Moraceae, and *Macaranga* sp., as well as bamboo.

In combination, the archaeobotanical evidence from the sediments and from the tools in the Hell Trench reveals a diverse range of plant-gathering activities in the period c. 50,000–35,000 BP. Palms such as sago were clearly important; the palm starch probably derives from the interior pith of the plant, used as a food source. Starches from toxic aroids, in particular those of *Alocasia* spp. and *Alocasia longiloba*, are well represented. The closest match for the yam starches is *Dioscorea alata*, the greater yam. The toxic *Dioscorea hispida* yam that is present in Late Pleistocene sediments (Chapter 6, p. XX) is not represented in the earlier phase of occupation, but its starches are small (under five microns), falling below the minimum size at which the starch grains were recorded (Volume 2, Chapter 19).

Forest disturbance [CH, LK]

A striking feature of the palynological record is the frequency of pollen grains of *Justicia* (Acanthaceae), beginning in Pollen Zone A-1, which lies below the zone with the first convincing signs for human presence in the West Mouth in the form of *in situ* scorching

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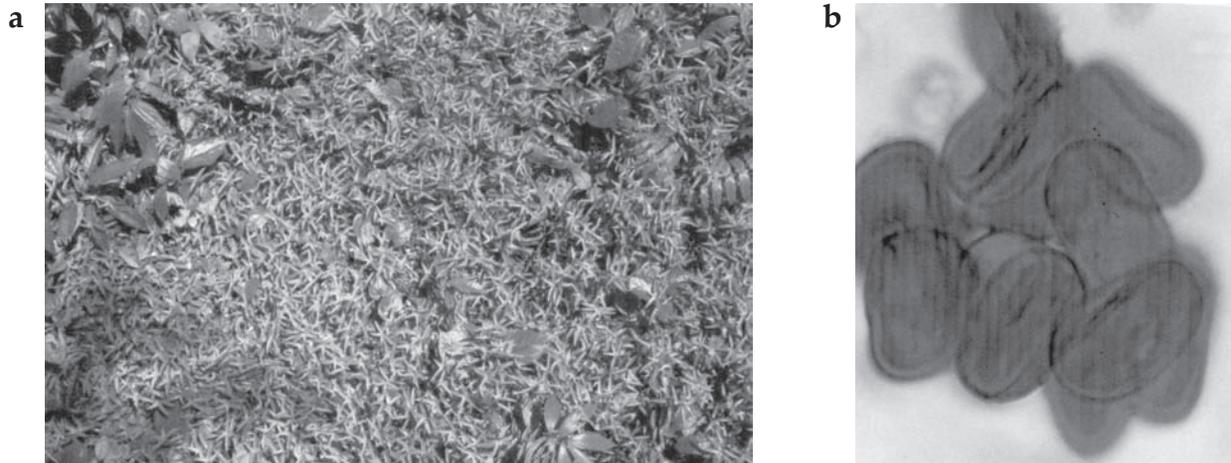


Figure 4.26. (Left) a sward of *Justicia* in the Niah National Park, and (right) a grain of *Justicia* pollen. The sward image measures approximately 1 m across, the *Justicia* pollen grains approximately XXX. (Photographs: Graeme Barker [sward] and Chris Hunt [pollen grain]) [COH to supply scale details; and magnification details?]

and charcoal deposition, but associated with a peak of thermally mature material, indicating burning (Table 3.2). *Justicia* today forms monospecific swards in the Niah National Park, following fire (Fig. 4.26). Peaks of *Justicia* pollen through the cave fill coincide with phases of high arboreal pollen, for instance in Zones A-1 to A-6, H-3, H-5 to H-7, H-9 and RS-1, indicating that fires coincided with episodes of dense forest. At these times, species typical of disrupted and regenerating forest canopy, such as *Macaranga*, *Albizia* and *Kleinhovia*, are also present. The phytolith analysis also provides evidence for burning. There were concentrations of burned silica and micro-charcoal especially in two sediment samples within the H-9 to H-11 sequence (samples 8M4 and 8M5) and burnt silica was common in context 3144 in the HP/6 baulk. Samples 8M4 and 8M5, and context 3150 in the HP/6 baulk, contained phytoliths of Euphorbiaceae that, if *Macaranga* or a comparable species, are secondary regrowth taxa, evidence for forest disturbance at this time linked to burning (though the burnt phytoliths and micro-charcoal could also be from hearths inside the cave mouth).

Although natural fires are regarded as a feature of Bornean ecosystems today (Goldhammer & Seibert 1989 NOT IN REFS), it is more likely that the *Justicia* curve in the West Mouth pollen diagrams reflects a regular pattern of deliberate biomass burning outside the cave, presumably to maintain and enhance existing open or disturbed areas of forest. Deliberate burning would have enhanced the forest-edge habitats that would have provided good locations for plants such as tubers that were desirable human foods, and which would also have attracted desirable game such

as pigs. Burning could also assist maintain sightlines for foragers and reduce cover for annoying insects. The beginning of forest burning at Niah is close to the time that anthropogenic biomass burning is first reported in Indonesia and Australia on the evidence of abnormally high numbers of microscopic charcoal particles in sediment cores c. 50,000 BP (Kershaw *et al.* 2002; 2003 NOT IN REFS; Thevenon *et al.* 2004), and somewhat earlier than in western Kalimantan (Anshari *et al.* 2004) and New Guinea (Summerhayes *et al.* 2010 NOT IN REFS 2009?).

Conclusion [TR, GB]

The new work undertaken in the West Mouth has provided independent confirmation that the original estimations for the age of the Deep Skull were largely correct: direct uranium-series dating of fragments of the skull, and associated radiocarbon dating of charcoal in closely associated sediments, indicate it to be of Late Pleistocene origin, c. 37,000–35,000 BP. The skull itself was not an isolated find, as has often been assumed in critical reviews of Niah since Harrison's time, but was closely associated with an extensive assemblage of vertebrate and other organic remains and occasional other archaeological artefacts including lithics and bone tools. The presence of quartz crystals within the sediments cleaned from the skull of a type not present elsewhere in the Niah Caves and with no proximate source within the lowlands around Niah points to the presence of an associated cultural deposit, while the distinctive palynological and geochemical signature of the skull sediments may be consistent with the skull being a burial. The finding of addi-

tional human remains from contiguous contexts, the presence of butchery marks on a sub-set of the fauna, and the presence of differential burning, all gleaned through the study of this assemblage, support Tom Harrisson's original contention that the principal agent of accumulation of the assemblage was anthropogenic. Furthermore, this assemblage started to accumulate thousands of years earlier than the burial of the Deep Skull: the earliest of the suite of new AMS dates on charcoal samples collected by the project suggest that human occupation of the West Mouth goes back to (at least) *c.* 50,000 years ago.

Occupation of the West Mouth during this early period appears to have been small-scale and concentrated along the cave rampart, with the accumulation of refuse occurring immediately inside the cave lip, through a combination of natural slope movement and deliberate deposition. Some of the vertebrate remains show clear signs of butchery, some of which was likely taking place on-site. The evidence points to intermittent visits by small groups of mobile foragers. The presence of juvenile human remains, if proven to be contemporaneous, would imply that these were normally familial groups.

They do not seem to have sought the cave interior out of any sense of a need for protection from the elements or even, so far as we can tell, for conducting rituals, both features of contemporary cave occupation for example in Pleistocene Europe. Indicators of the Deep Skull being several thousand years younger than the sediments in which it was probably found by the Harrissons suggest that the young woman whose remains ended up within the silts and sands of the rock channel may well have been deliberately buried in a pit dug from a higher, later, surface, as opposed to being left on the surface (with or without ceremony) at the cave lip or in the cave entrance much like the food waste that accumulated in the same channel. One hint at the ritual life of the society of which she was a part, though, is the red pigment (probably a tree resin) found on a piece of turtle shell and on the inside of three pieces of human skull from levels likely to be of similar antiquity to the Deep Skull. The red wash could mean that skulls were used as convenient receptacles for mixing a colouring medium, or that they were directly involved in rituals focused on the body in death. Either way, if dating in the future shows the turtle and skull fragments to be of the same approximate antiquity as the Deep Skull, the use of pigmentation at this time at Niah would be particularly intriguing as it has been linked to 'modern' human behaviour (McBrearty & Brooks 2000) — though it appears in the European as well as the African records as early as 300,000 BP (Barham

2002 **NOT IN REFS**).

The modern humans who camped in the West Mouth *c.* 50,000–35,000 BP do not exhibit the classic indicators of 'modernity' of, for example, the European Aurignacian, such as a refined lithic and bone technology, body ornamentation (necklaces and the like), and mobiliary and parietal art (Mellars 2005 **NOT IN REFS**). However, their foraging systems certainly demonstrate intimate knowledge of the arboreal, terrestrial and aquatic environments around them; careful scheduling, targeting and planning in resource exploitation; 'long-chain' production sequences, with lithics used to produce organic tools; and the deliberate manipulation of the forest to enhance its productivity. They were clearly able to exploit tropical rainforest: the landscape was more varied than modern tropical rainforest, but it certainly included the latter, which in fact provided the human groups using the West Mouth in this period with key food resources such as edible tubers, sago palm and primates.

The fact that Borneo was throughout the period in question connected to the mainland of Southeast Asia (Fig. 4.1) means that there was a geographical opportunity for incoming *Homo sapiens* to meet late *Homo erectus* in Java (should the late dates be valid), although there may have been other ecological barriers that kept them apart. The water barrier between Sundaland and the population of *Homo floresiensis* in Flores may have meant that there was no direct competition, but dates for the earliest occupation of Australia suggest that this barrier (if it was such) was rapidly overcome (Hiscock 2008). *Homo floresiensis* may have had a different ecology that avoided direct competition with *Homo sapiens*, but the archaeological record does not provide any evidence to support this: it was a hunter of a mixed range of species, with dwarf *Stegodon* as the main prey species, and an unknown exploiter of plant resources (Brumm *et al.* 2006; Morwood *et al.* 1999; 2004). It is conceivable, therefore, that *Homo floresiensis* was in the Bornean part of Sundaland in the period 50,000–35,000 BP (and even *Homo erectus* in the unlikely case that it was still extant), but given the similarities of the behavioural evidence in the pre-Deep Skull deposits in the West Mouth with that associated with the Deep Skull, it is legitimate to conclude that the pre-Deep Skull archaeology was left by modern humans rather than by any other species.

The Niah Caves do not contribute significantly to the debate about when modern humans first reached Sundaland, but their critical importance is that they provide robust evidence not only for the latter's presence here from *c.* 50,000 BP but also for how they were behaving. The debate about the emergence of modernity in the Pleistocene suffers from circular reasoning,

with ‘archaic’ or ‘modern’ human fossils ascribed particular sets of behaviour despite the lack of associated evidence for the latter, and sets of ‘archaic’ or ‘modern’ material culture ascribed to particular species without associated fossil evidence, despite increasing evidence that such assumptions are unwarranted, as in the use of Levantine Mousterian industries by both Neanderthals and modern humans in the Near East (Bar-Yosef & Pilbeam 2000; Lieberman & Shea 1994). Niah is currently the only site in the entire region of Southeast Asia and Australia in the 50,000–35,000 BP time bracket with a well-dated human fossil associated with good evidence for the behaviour of that hominin;

and in this case they are both strikingly ‘modern’.

The new work at Niah has therefore been able to answer the questions posed earlier in this chapter about the date of the earliest human presence at the site; whether it was *Homo sapiens* or a different species; the environments they encountered; and how the latter were exploited. The question about whether modes of behaviour remained stable or changed through the Late Pleistocene will be addressed in the next chapter. The larger question posed earlier remains: what was it that provided modern humans with the competitive advantage to replace earlier, locally adapted, populations? We return to this question in our final chapter.

