

POST-PLEISTOCENE CHANGES IN THE MAMMALIAN FAUNA OF BORNEO

ARCHAEOLOGICAL EVIDENCE FROM THE NIAH CAVES

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SUMMARY

In the archaeological deposits at Niah cave, Sarawak, which have been dated by C^{14} techniques, mammalian remains from levels representing periods earlier than B.C. 17,613 \pm 190 provide a sample of the later Upper Pleistocene fauna of lowland Borneo. At least fifty species have been recognised, although not all can be finally identified. Of those identified, the majority are still extant in Borneo although one, a giant pangolin, is totally extinct, another, the Malay tapir, no longer occurs on the island, and two more, the Sumatran rhinoceros and the orang-utan, nowadays have a restricted distribution in Borneo, not including the Niah region. In addition, several extant species are represented by Pleistocene congeners of slightly larger average size. Two other mammals, the lesser gymnure and the ferret-badger, today have a limited montane distribution; their presence in the deposit suggests a lowering of the mean ambient temperature by about 5°C during the end of the Pleistocene. Of other large mammals which might have been expected, neither the Javan rhinoceros, the Indian elephant, nor the tiger are represented, although a fragmentary canine crown, attributable to a young tiger, has been recovered from Neolithic levels.

IN JAVA, fossiliferous strata, including the famous Trinil and Djertis beds, have yielded large collections of Pleistocene mammalian remains. No parallel deposits are known in nearby Borneo, and the few fossils available of supposedly early or Middle Pleistocene age were found more or less accidentally in unstratified contexts. Since 1954, however, systematic excavation of the deposit in the west mouth of a large cave at Niah (plate IVA), in north central Sarawak, undertaken by Mr. Tom Harrison, Curator of the Sarawak Museum, and his associates, has produced a great number of fragmentary animal remains dating from the late upper Pleistocene to the recent period. Mammalian remains constitute the bulk of the material, and have also been the class most intensively studied. Many species have been identified, and the mammalian fauna of this period is now known in some detail.

Geologically, the lower boundary of the Pleistocene is defined by the first appearance of fossils of its characteristic species. The upper limit is not so clearly definable

Reports on different elements of the mammalian material from Niah have been published by von Koenigswald, Hoojer, Tom Harrison, Clutton-Brock, Cranbrook and Aldridge, and myself, principally in the *Sarawak Museum Journal*. Progressive accounts of the excavation as a whole have also been published by Tom Harrison, in the *Sarawak Museum Journal*, *Man*, and elsewhere. I personally assisted at the excavation on the site in 1958, and have since then been responsible for most of the crude sorting and preliminary identification of all animal remains recovered at all stages. I have drawn on all these sources, as well as a certain amount of unpublished data, in compiling this summary. [A basic bibliography is given in Tom Harrison's paper preceding this one.—Ed.]

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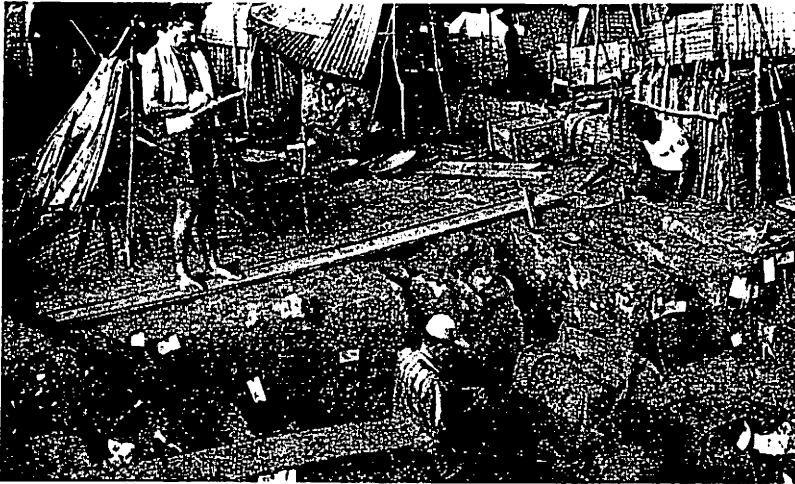


PLATE VA

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Working below the 100-in. layer, on which the author is standing, in "Hell" at c. 50,000 B.C. in Niah Great Cave.

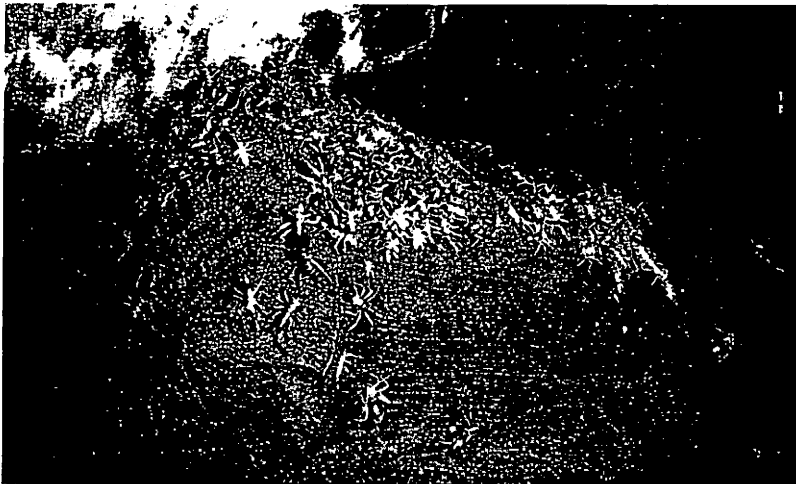


PLATE VB

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A colony of the aberrant carwig *Arixenia commensal* with the Naked Bat (*Cheiromeles*), the single Niah Cave Colony, in complete darkness, now enclosed in the world's only carwig sanctuary. Two in left foreground are copulating.

in terms of fauna, particularly in the tropics where there was no sharp climatic transition comparable to the end of the last ice age in the north temperate zone. Fortunately, the age of the deposit at Niah at different levels of the dig has been established independently, not by reference to the fossil fauna, but by Carbon-14 dating techniques based on charcoal samples assayed at Groningen by the late Dr. de Vries. In the main pit, the time scale has been related to depth by the following samples:

- (1) A sub-surface sealing layer of ash, varying from 9 to 16 inches in depth, dated as B.C. 502 ± 70 .
- (2) At c. 48 inches depth, dated as B.C. $17,613 \pm 190$.
- (3) At c. 72 inches depth, dated as B.C. $30,673 \pm 700$.
- (4) At 96–100 inches depth, dated as B.C. $37,643 \pm 1,000$.
- (5) At c. 100 inches depth, dated as B.C. $39,543 \pm 1,000$.

These dated carbon samples form a consistent series indicating, at the lower levels of the deposit, an overall time-depth scale of 2.4 inches per 1,000 years. The 48 inch level, dated at B.C. 17,613, corresponds closely enough to the accepted date for the end of the Pleistocene, and for the purpose of this summary is taken as the upper limit of the Pleistocene deposits in that part of the cave.

Human remains have been recovered from all levels at Niah, both Pleistocene and subsequent, and the greater part of the animal material clearly owes its presence in the deposit to human activity. The matrix of the deposit is non-calcareous, powdery to the touch and rather firmly compacted. All animal remains are quite unmineralised. In the upper levels the moisture content is low, but as the depth increases the matrix becomes progressively damper. At the same time, the state of preservation of mammalian remains, which comprise bones and teeth, deteriorates correspondingly and it is evident that the damper conditions are less favourable for their survival.

Nowadays several species of bat roost in the cave, and small insectivores and rodents enter it freely. Representatives of both groups have been identified among the archaeological material, and may be the remains of individuals that died in the cave after entering it voluntarily. On the other hand, no animal skeletons have been found in even partial articulation and the bones of most large mammals are in many cases represented only by broken fragments. Usually even fragments are unassociated, and the pattern of their occurrence and the nature of their fractures indicate that these larger bones were broken before being incorporated in the deposit. The characteristic chipped edges and irregular pitting that are the result of gnawing by large carnivores are only found on fragments in the uppermost layers of the deposit, associated with artifacts of Neolithic and later cultures. Only in these levels too, do remains of dog occur. There are no native wild canids in Borneo, and the skeletal remains and the signs of gnawing are both attributed to domestic dog.

Fragmented bones from deeper levels must have been broken by men, presumably in order to get at the marrow. In addition, from all levels are found fragments of mammalian teeth and bone which have been more or less extensively worked to produce artifacts, some of great sophistication. Charcoal occurs throughout the deposit, and charred fragments of mammal skeletons are found at all levels, further evidence that their presence is due to human activity. Finally it should be noted that the skeletal remains of large mammals represent both old and young, and not merely

aged individuals that might of their own accord have come to the cave to die.

It is clear on all counts that the skeletal fragments of at least the large mammals, and probably of many small species as well, represent primarily the food remains of human visitors to the cave. Subject to possible limitations of hunting equipment (and perhaps dietetic taboos against selected species), these remains are likely to represent a broad sample of the available mammalian fauna of the natural late upper Pleistocene habitat in Borneo.

Taking the 48 inch level as the upper limit, the total assemblage of species represented in this late Pleistocene sample is found to be very similar to the mammalian fauna of the modern tropical south-east Asian forest habitat. The list comprises: INSECTIVORA—Lesser Gymnure (*Hylomys suillus*), and a white-toothed shrew (*Crociduraf. foetida*). CHIROPTEA—a rousette bat comparable in size to *Rousettus amplexicaudatus*, and another somewhat larger species of the same genus, and the Cave Fruit Bat (*Eonycteris spelaea*): several round-leaf horseshoe bats, including *Hipposideros diadema*, and smaller species; the Trefoil Horseshoe Bat (*Rhinolophus trifolius*) and the Borneo Horseshoe Bat (*R. borneensis*); two species of bent-winged bats (*Miniopterus*), a wrinkled-lipped bat (*Chaerephon* sp.), and the Hairless Bat (*Cheiromeles torquatus*). PRIMATES—a treeshrew (*Tupaia* cf. *minor*), the Silvered Leaf-monkey (*Presbytis cristata*) of the subgenus *Trachypithecus*, and other leaf monkeys of the subgenus *Presbytis*, the Long-tailed Macaque (*Macaca fascicularis*) and the Pig-tailed Macaque (*Macaca nemestrina*), the Bornean Gibbon (*Hylobates moloch*), and the Orang-utan (*Pongo pygmaeus*). PHOLIDOTA—the Pangolin (*Manis javanica*), and a large extinct relative, *Manis palaeojavanica*. RODENTIA—several rats, including the large Müller's Rat (*Rattus muelleri*) and the Long-tailed Giant Rat (*R. sabanus*); the Giant Squirrel (*Ratufa affinis*), a small squirrel probably Low's Squirrel (*Sundasciurus lowi*), and the peculiar Bornean Tufted Ground Squirrel (*Rheithrosciurus macrotis*); and a large porcupine (*Hystrix* or *Thecurus* sp.). CARNIVORA—the Malay Bear (*Helarctos malayanus*), the Malay Weasel (*Mustela nudipes*), the Ferret-badger (*Helictis orientalis*), the Hairy-nosed Otter (*Lutra sumatrana*), the Bearcat (*Arctictis binturong*), and the Leopard Cat (*Felis bengalensis*). PERISSODACTYLA—the Malay Tapir (*Tapirus indicus*), and the Sumatran Rhinoceros (*Didermoceros sumatrensis*). ARTIODACTYLA—Bearded Pig (*Sus barbatus*), the Larger Mousedeer (*Tragulus napu*), Barking Deer (*Muntiacus muntjak*), the Sambhur or Rusa (*Cervus unicolor*), and wild cattle (*Bos* probably *javanicus*).

Only one species in this list is totally extinct. This is the Giant Pangolin which is represented at Niah by three bones, unmineralised and clearly not erratics in the deposit, occurring at 104–110 inches alongside material attributable to the extant species, *M. javanica*, which is less than a half its size in linear dimensions. These fossils are considered by D. A. Hooijer to be conspecific with *Manis palaeojavanica*, hitherto known only from middle Pleistocene deposits in Java. The Niah specimens thus constitute an extension of the known range of this extinct pangolin in both space and time. The three bones are closely grouped, and probably represent one individual. Their depth indicates, by extrapolation from the established time-depth regression, that this giant pangolin survived in Borneo until at least c. B.C. 40,000–45,000.

A second species, the Malay Tapir, is now locally extinct in Borneo. This big ungulate survives today only in Sumatra, the Malay States, and adjacent parts of

continental South-east Asia. As a fossil, however, it is known from Pleistocene deposits in China and Java, and it is already clear that since the late Pleistocene its range has been steadily diminishing. Its presence in Pleistocene Borneo is not surprising. The island stands on the Sunda Shelf, the South-east Asian continental shelf, in close relation to Sumatra, Java and Malaya. During the Pleistocene, the periodic recessions of sea level associated with the ice ages greatly reduced, if not eliminated the sea barrier, facilitating the spread of mammals between these now isolated land masses. Eight footbones of tapir and two teeth have been identified from material from the west mouth at Niah. One fragment occurred above the 24 inch level, indicating by interpolation that the species survived well into the post-Pleistocene, until at least c. B.C. 7,000.

Although the tapir was evidently hunted (and presumably eaten) by early man, its remains are not abundant in the deposit at Niah, and there is no evidence that human predation contributed to its extermination. The living tapirs are survivors of a once widespread group, well represented by fossil forms in Eurasia and America. It is clear that the group as a whole is poorly adapted to prevailing conditions, and is naturally declining. Conservation projects may prevent the acceleration of this decline, but are unlikely to arrest it permanently.

The position of the Orang-utan is probably similar. Like the tapir, it ranged from China to Java in Pleistocene times but today is restricted in numbers and distribution, occurring wild only in parts of Sumatra and Borneo. Within the historical period there have been no records of Orang-utan, apart from casual vagrants, anywhere in the environs of Niah. The archaeological material, occurring at all levels from the deepest to the most superficial, serves to demonstrate that within Borneo during the post-Pleistocene period even before the recent onset of intensive persecution by man, the Orang-utan was already declining.

D. A. Hooijer has published a detailed study of the dental material of Orang-utan from the Niah excavation, and has shown that there is a tendency for overall decrease in size from the late Pleistocene to the present. This trend has been demonstrated widely among mammals from Indonesian sites, and there are parallel indications among other species at Niah, including leaf-monkeys of both subgenera *Presbytis* and *Trachypithecus*, as well as the Long-tailed Macaque, several bat species, the Barking Deer, Müller's Rat and the Long-tailed Giant Rat.

Thus although the overall similarity of the terminal Pleistocene fauna to the extant fauna precludes any major change in climate or in the habitat in general during the transitional period, these two phenomena, local extinction and evolutionary changes in mean body size of species, nonetheless suggest progressive alteration of conditions. The presence in Pleistocene levels of two other mammals, the Lesser Gymnure and the Ferret-badger, both today characteristically submontane in distribution, gives some indication of the nature of this alteration.

The Ferret-badger (*Helictis orientalis*) today occurs only in mountainous parts of Java, and in Borneo on Mt. Kinabalu from 3,500 feet upwards. It is represented at Niah by a jaw fragment from the 54-60 inch level. The Lesser Gymnure (*Hylomys suillus*) is known from high ground in Malaya, Sumatra and Java, and from Mt. Kinabalu, Mt. Trus Madi and the Kelabit uplands in Borneo. Throughout its range it is largely restricted to altitudes above 2,000 ft. It never has been trapped and is

unlikely ever to be trapped, in the low-lying forest surrounding the limestone outcrop at Niah, the foot of which is no more than 40 ft. above mean sea level. In the cave deposit this small insectivore is represented by a broken left mandibular ramus, from 93-96 inches depth, recognised by Lord Cranbrook.

The ecological factors which nowadays prevent the downward spread of these highland species have not been studied, but are likely to be related to mean ambient temperature which of course decreases with ascending altitude. In this context it is interesting to note that geologists in Africa have adduced evidence for a lowering of the mean ambient temperature in the equatorial zone during the end of the Pleistocene. In Borneo a drop of about 9°F. (5°C) would correspond to an altitude increase of approximately 3,000 ft., and would put the temperature at Niah within the range nowadays experienced only in submontane habitats.

While the discovery of the tapir among the late Pleistocene fauna of Borneo was not totally unexpected, there are other species which might have been found, yet are absent. There is for instance to date no evidence of any rhinoceros other than the small Sumatran, or Asiatic Two-horned Rhinoceros (*Didermoceros sumatrensis*). The larger Javan Rhinoceros (*Rhinoceros sondaicus*) exists on Java, and also alongside the Sumatran Rhinoceros on continental South-east Asia. Its presence in Quaternary Borneo has been claimed by earlier authors, but re-examination of the fossils concerned does not support this identification. Some of the rhinoceros foot bones from Niah are larger than their homologues in the skeleton of recent *D. sumatrensis* but this difference could equally well signify increased body size in the Pleistocene antecedents of the modern population. An evolutionary change of this nature has already been demonstrated among Sumatran material of *D. sumatrensis* by D. A. Hooijer.

The Indian Elephant also appears not to be represented in the Pleistocene fauna of Borneo, although one of the tapir bones from Niah was at first identified (and published) by von Koenigswald as elephant. Indian Elephants are found today in extreme north-east Borneo, where several thousand head are estimated to occur. Although the Indian Elephant extends on continental Asia as far as the Malay peninsula, and although the Middle Pleistocene elephant *Palaeoloxodon namadicus* is known as an isolated fossil from eastern Borneo, it is generally held that the living elephant population of north-east Borneo represents the feral descendants of imported stock. Niah provides no archaeological evidence to refute this statement.

An unsolved problem, apparently not related to the Pleistocene fauna, is posed by the discovery of an isolated fragmentary crown of an unworn upper canine of Tiger (*Panthera tigris*) from near-surface levels at 6-12 inches, recognised by D. A. Hooijer. The Tiger has never been reliably recorded from Borneo within historic times, although its range includes the other chief land masses of the Sunda Shelf and might be expected to have extended to Borneo in the Pleistocene. This single tooth, evidently of a young animal, is not yet supported by other finds from deeper levels. In the circumstances, there is no indication whether it represents a survivor from the native Pleistocene fauna of Borneo, or a later import, perhaps in the form of a tame tiger cub, by human agency.