CHAPTER FIVE

RE-ASSESSMENT STUDIES; IMPORTANT FOSSIL FINDS

5.1 Introduction

This section deals with some fossil finds from two sites (Datok Cave and Naga Mas Cave) in the Kinta Valley, Perak, Peninsular Malaysia. These sites had been discovered and studied by Hooijer (1962a), Adi Haji Taha (1993), Davison (1993), Tjia (2000), and additional work on the fossils and associated geology are discussed here.

5.2 First site: Tambun ; Datok Cave and Hooijer's Collection

The first site of great historical interest in the Kinta Valley is where one of the earliest systematic studies on fossil mammalian fauna from Peninsular Malaysia was conducted by Dick Hooijer (Leiden) in 1962a. This collection of bones and teeth was collected from a cave near Ipoh, the capital of Perak. The materials were collected by Peacock, Curator of the Perak Museum, Taiping, Perak, who did not give any details of the location. It was most likely the material come from the high level cave about 600 steps lead to big and dark chamber cave known as Gua Datok or Datok Cave (Figure 5.1) in part of an extensive limestone hill (with several cave openings) that reaches up to about 448 m high located within the compound of the Lost World of Tambun Water Theme Park at present. It has been speculated by some palaeontologists that this cave or others in the nearby area might have been the field locality where the important Hooijer Collection originated (Davison, 1991).

The whole collection comprising 51 specimens contains at least seven kinds of mammals from the Middle Pleistocene period (about 781,000 to 126,000 years ago. This age estimation single out these fossils as the oldest known prehistoric mammal fauna in Malaysia and bears witness to the great antiquity of the modern day mammalian diversity.

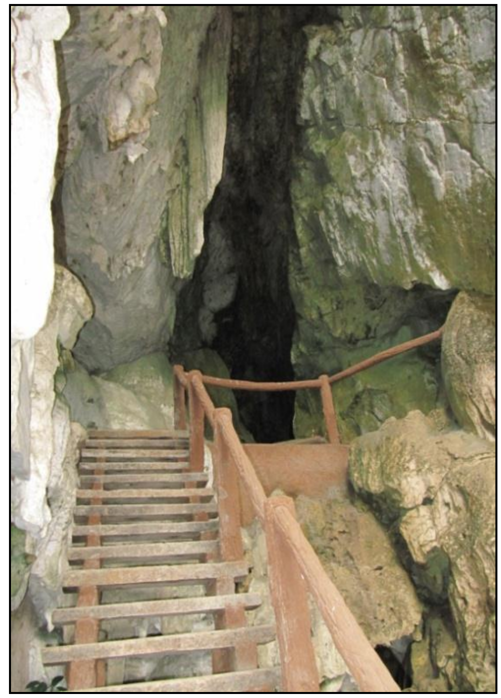


Figure 5.1 Datok Cave.

Furthermore, two extinct species which have important bearing on past climate and distributional patterns of mammals had been identified: a hippopotamus and an antelope (*Duboisia santeng*). Hippopotamus still has living representatives in Africa but the *Duboisia* is a totally extinct genus originally described from materials exclusively found in the Middle Pleistocene of Java. Both seem to indicate the existence of a grassland-type of habitat in the past which was somewhat different from the close-canopy rainforests in the area today. The few palaeontological investigations on geologically younger sites carried out in the decades following the publication of Hooijer's (1962a) paper had not produced remains of these species. It is, therefore of great scientific importance to reexamine these materials, especially in the light of recent developments and advances in Southeast Asian Pleistocene palaeontology.

5.2.1 Present location of the specimens in Hooijer's Collection

Unfortunately, the specimens in this important collection are no longer kept together in one place but have been dispersed with some of them untraceable. A specimen of third lower molar of a pig was found in Zoological Museum in the University of Malaya. Where are the others? Enquiries from colleagues drew a blank at first until nine specimens from the collection were found during a chance visit to the newly renovated prehistory display at the National Museum of Malaysia last year (Figure 5.2).

The whole collection was not represented in the exhibition room and specimens of *Duboisia* that are of most critical were absent. In view of its dual chronological and faunistic uniqueness, and frequent citation in foreign professional literature, it is of utmost significance that the complete Hooijer's Collection be located and made available to both specialists and the interested general public.

Figure 5.2 Hooijer's Collection at the National Museum of Malaysia.

5.2.2 Description of samples found in Hooijer's Collection

Hooijer (1962a) had not included any pictures and some samples are without measurements in his paper. The measurements in this text are new and not included in Hooijer paper. These are the samples that were found with the details: Collector's / Cataloguers' old code number, new code number by the museum's, anatomical identity, species identity, measurements in mm, and photographs of the specimens.

<u>Sample at the Zoological Museum in the University of Malaya</u>

1. (Figure 5.3)

Old cod number: 57 / 1.13

New cod number: 3.16

Anatomical identity: lower M_3 dexter

Species identity: *Sus* sp.

Measurements: Anterior-posterior length: 35.0

Width: 18.0

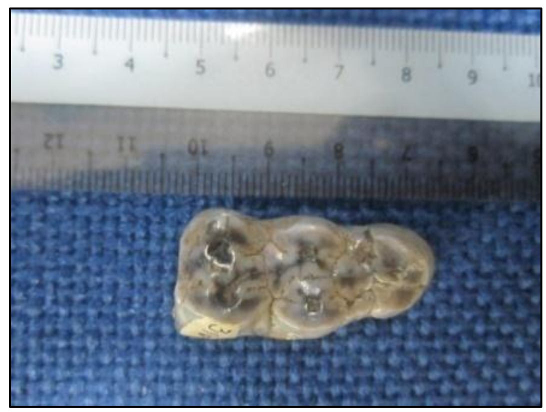


Figure 5.3 Occlusal view of *Sus* sp.

<u>Samples at the National Museum (Malaysia)</u>

1 . (Figure 5.4)

Old code number: 57 / 1.16

New code number: 3.3

Anatomical identity: upper P^4 dexter

Species identity: *Rhinoceros sondaicus*

Measurements:

Ant. Width: 37.1

Post. Width: 37.4

Figure 5.4 Occlusal view of P^4 *Rhinoceros sondaicus*

Length of crown (measured at buccal side): 30.2

Notes: It does not seem to be a P^4 but more like a P^2 or P^3

2. (Figure 5.5)

Old code number: G.S. 15

New code number: 3.4

Anatomical identity: upper M^3 sinister

Species identity: *Rhinoceros sondaicus*

Measurements:

Figure 5.5 Occlusal view of M^3

Rhinoceros sondaicus

Antero-transverse

(Max., measured at the root): 46.7

(Measured at crown-root junction): 46.0

(Top of cusps): 37.6

Length of outer surface: 48.7

3. (Figure 5.6)

Figure 5.6 Thoracic vertebra of *Rhinoceros sondaicus*

Old code number: G.S. 18

New code number: 3.7

Anatomical identity: Thoracic vertebra

Species identity: *Rhinoceros sondaicus*

Measurements:

Height of the centrum at the posterior side: 47.4

Height of the centrum at the anterior side: 49.0

Width of the centrum at the anterior side: 45.3

Height of the vertebra foramen at the anterior side: 23.4

Width of the vertebra foramen at the anterior side: 26.2 **(**Figure 5.6A)

Length of the spinous process at the base: 61.5

Width of the vertebra across the transverse processes: 93.5

Figure 5.6A Width of the thoracic vertebra foramen at the anterior side

4. (Figure 5.7)

Old cod number: G.S. 20

New cod number: 3.9

Anatomical identity: proximal portion of scapula

Species identity: *Rhinoceros sondaicus*

Figure 5.7 Proximal portion of scapula of *Rhinoceros sondaicus*

Measurements:

Longest length of the processus articularis (GLP): 63.3

Shortest length of the collum scapulae (neck of the scapula) SLC: 59.2 **(**Figure 5.7A)

Vertical diameter: 55.1

Figure 5.7A Shortest length of the collum scapulae (neck of the scapula).

5 . (Figure 5.8)

Figure 5.8 left scaphoid of *Rhinoceros sondaicus*

Old code number: 57 / 1.6

New code number: 3.10

Anatomical identity: left scaphoid

Species identity: *Rhinoceros sondaicus*

Measurements:

Length of the scaphoid measured at the dorsal surface: 2.7

Width of the scaphoid measured at the articular surface with the radius: 43.9

6. (Figure 5.9)

Figure 5.9 left unciform of *Rhinoceros sondaicus*

Old code number: 57 / 1.7

New code number: 3.11

Anatomical identity: left unciform

Species identity: *Rhinoceros sondaicus*

Measurements:

Anterior –posterior diameter: 79.6

Transverse diameter: 59.9

Vertical diameter: 46.2

7. (Figure 5.10)

Old code number: 57 / 1.1

New code number: 3.17

Anatomical identity: shaft of immature right radius

Figure 5.10 Right radius of *Hippopotamus* sp.

Species identity: *Hippopotamus* sp.

Measurements:

Widest width of the proximal end (Bp): 64.9

Longest length (GL) (along the postulated free edge, not attached to ulna): 160.2

Narrowest width (SD) (across a foramen-check anatomical term): 27.9

Widest width of the distal end (Bd): 66.16

Length of diaphysis: 145.6

Proximal diameter: 53.9

Distal diameter: 59.4

8. (Figure 5.11)

Old code number: 57 / 1.5

Figure 5.11 Rib fragment of *Bibos* c.q. *Bubalus* sp.

New code number: 3.35

Anatomical identity: rib fragment

Species identity: *Bibos* c.q. *Bubalus* spec.

Measurements:

Median Length (preserved part): 129.4

Width at the dorsal side: 29.0

Length at the dorsal side: 12.5

Width at the ventral side: 23.9

Length at the mid section: 14.4

9. (Figure 5.12)

Part of metapodial with unclear numberings (57 / ?) and (3.?). It is not possible to determine to which original material it belongs to**:** Rhino? *Bibos*? Perhaps it is a rib of *Bibos*

Measurements:

Length: 141.8

Mid. Width (Medio-lateral): 29.5

(Ant.-Post.): 15.31

Distal Diameter (Medio-lateral): 32.4

(Ant.-Post.): 28.7

Figure 5.12 Part of metapodial perhaps to *Bibos*

5.3 Second site: Naga Mas Cave

Gua Naga Mas, is meaning Golden Dragon Cave in Malay, is a small cave or rock shelter situated in a small limestone hill south of Ipoh, Kinta Valley. A near complete skeleton of a medium sized mammal about 98cm long is embedded in travertine layers, on the ceiling about 7 m above the irregular cave floor. The cave floor is about 31m above the ground level of the Kinta Valley plain (Figure 5.13) (more details in chapter 2).

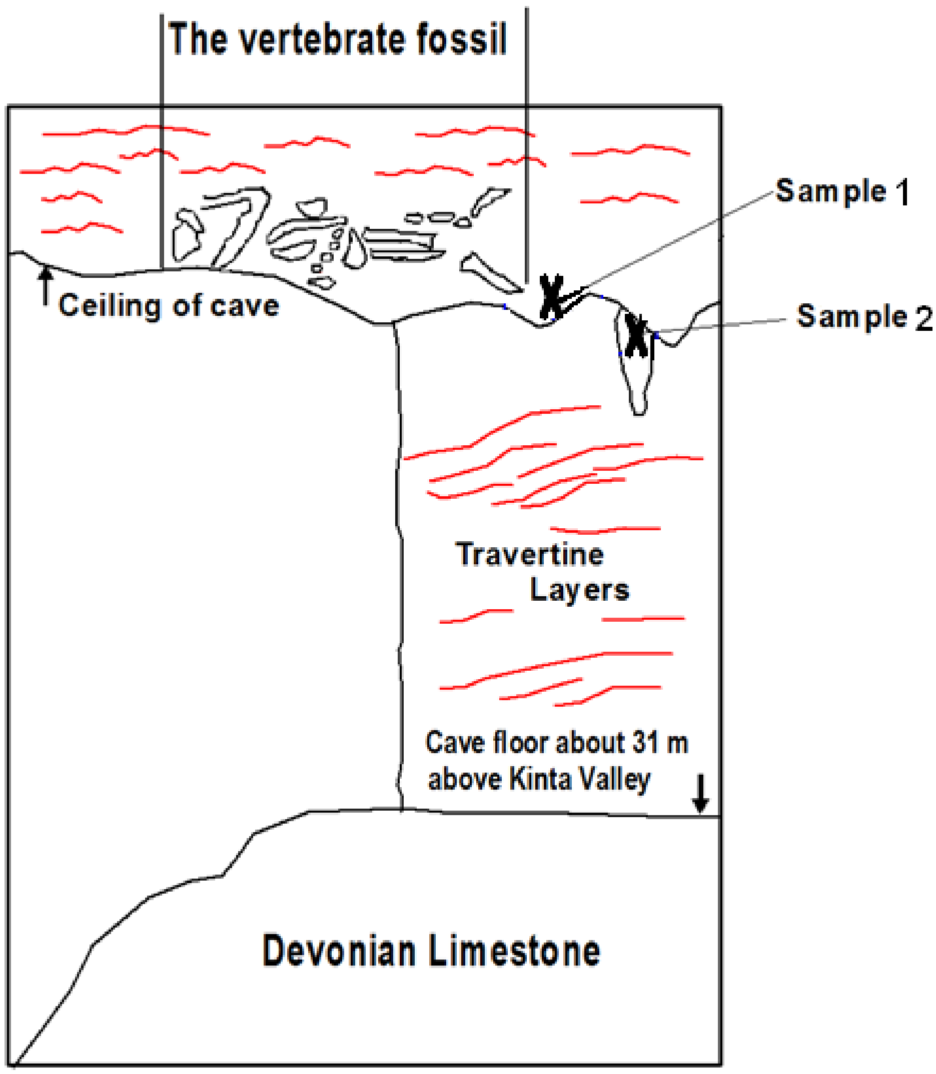


Figure 5.13 Sketch of Naga Mas Cave showing the vertebrate fossil embedded in the ceiling of the cave and the location of Samples 1 and 2 for dating (modified from Tjia, 2000).

5.3.1 What is that fossil?

Since its first discovery in 1992, no detailed studies had been done on the bones to identify the animal with certainty. Dr. Geoffrey Davison (1993) of the Singapore National Parks Board had tentatively identified the fossil as a possible modern Tiger (*Panthera tigers*). It has also been suggested that it could be an extinct Middle Pleistocene Tiger (*Panthera palaeojavanica*), a modern Lion (*Panthera leo*), or a Bear (*Ursus* sp.) by Adi Haji Taha (1993) and Tjia (2000).

Figure 5.14 General view of the fossil skeleton embedded in the travertine on the ceiling of the Naga Mas Cave.

5.3.2 Age of fossil

The age of the fossil is at least Late Pleistocene (Tjia, 2000). There were many previous attempts acertain the age of the fossil but the exact age is still not known for sure (details on dating methods in chapter 2).

5.3.3 Present study

It is not easy to specifically identify the animal from this skeleton because many parts are half embedded in the cave wall. Close up measurements for each part of the skeleton had to be taken in order to identify them. A scaffolding was built in 2009 and used by the author and other researchers to reach the fossil for close up photos and measurements of each part of the skeleton for more certain identification (Figure 5.14).

Two samples of the associated cave deposits were collected by drilling near the skeleton. Sample 1 was taken from the same layer of sediments 30 cm from the skeleton and Sample 2 was taken from part of a flowstone 35 cm from the skeleton (Figure 5.13). They were sent for dating to Dr. Kira E. Westaway at the Department of Environment and Geography, Macquarie University, Australia using Luminescence techniques.

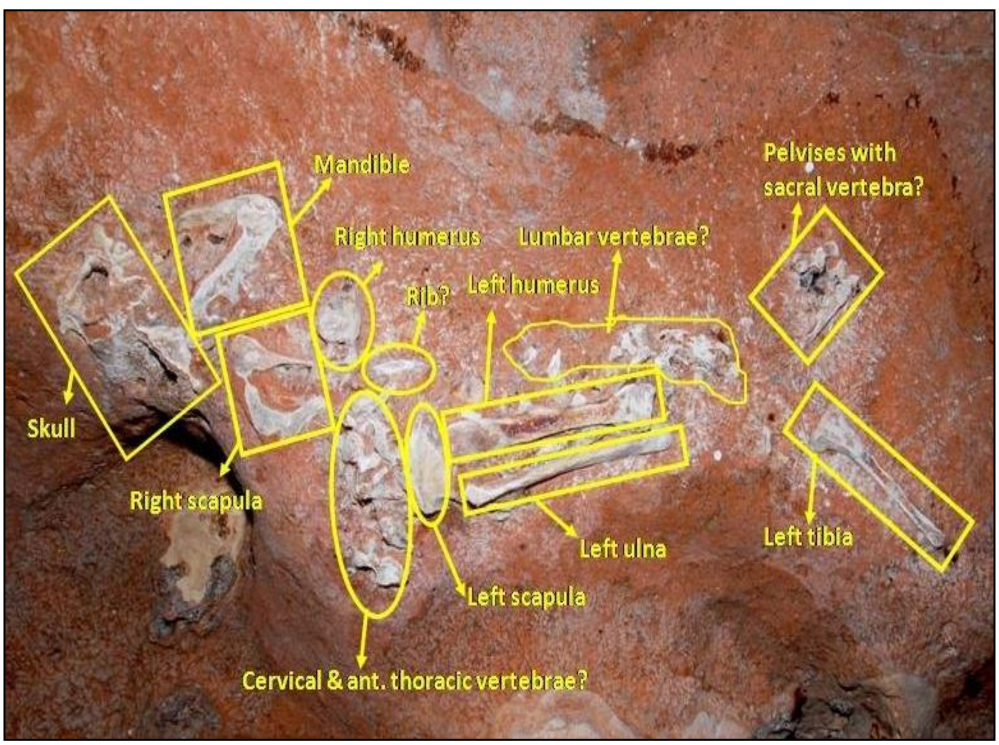


Figure 5.15 Close up photo and identification of each part of the Naga Mas skeleton.

5.3.4 Results of Naga Mas Cave

The skeleton clearly belongs to a mammal stretched out on its right side with only the left side exposed. It is almost complete with some parts eroded away. The following is a detailed description for each part with close up photos and measurements in mm.

A. Mandible and lower dentition (Figure 5.15)

The symphysis appeared parted and broken naturally after death. The chin is exposed. The left side of the jaw was partially eroded including bone lost from under the incisors to show teeth and roots in section. No incisor teeth was preserved but the right canine was clearly seen although the upper portion of this canine was not visible as it was embedded in the rock with only the lower portion exposed. The measurements in (Table 5.1).

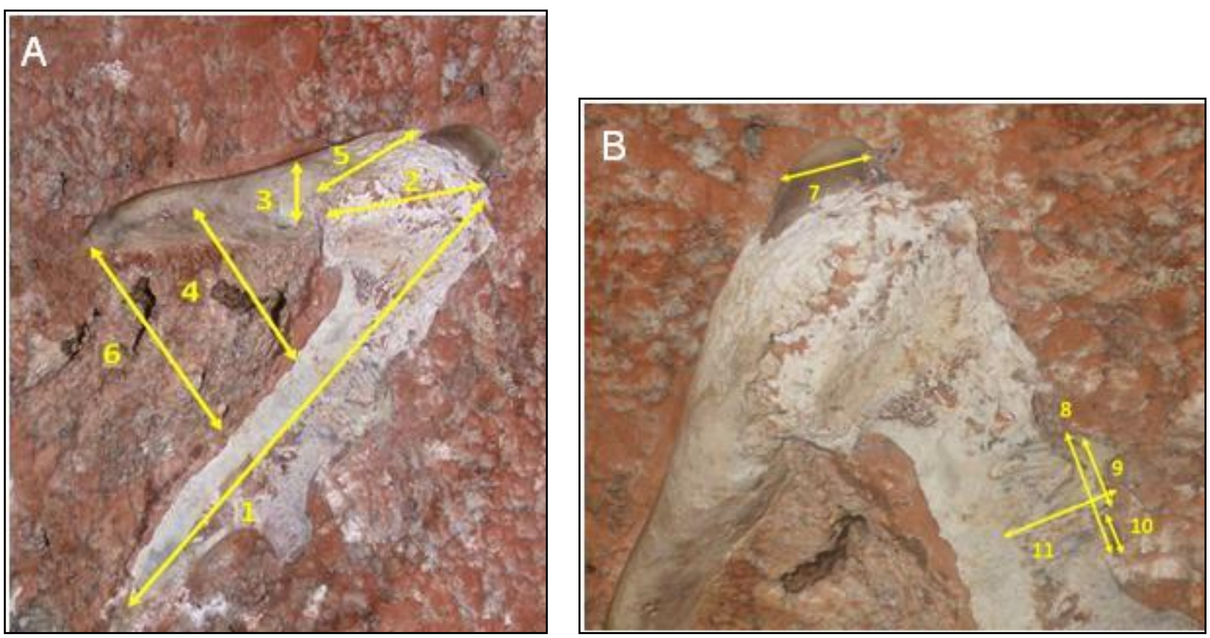


Figure 5.16 Close up photo of mandible and lower dentition of Naga Mas fossil.

Table 5.1 Measurements of mandible and lower dentition of Naga Mas fossil.

No.	Mandible (Measurements taken at left side)	
1	Length of jaw (symphysis to angular process)	141.0
2	Length of symphysis (Ant.)	46.0
3	Width of right jaw bone below canine	12.1
4	Interior width of jaw arch under M_1	29.3
5	Height of mandible behind canine	41.5
6	Anterior breadth of mandible arch (Ant. of ascending ramus)	43.7
	Lower Dentition (Measurements taken of left side teeth)	
7	Ant.-Post. length right canine from enamel base	18.5
8	Length of M_1- M_2 (ant. of M_1 - post. of M_2)	24.2
9	Ant.-Post. length M_1	19.2
10	Ant.-Post. length M_2	6.4
11	M_1: Posterior tubercle to root height	16.4

B. The Skull (Figure 5.16)

The skull was located under the lower jaw with its posterior part well exposed while the anterior part is not visible. The ventral surface was facing up with a clear opening, the foramen magnum. This foramen magnum with its right occipital condyle (mostly eroded) was visible, while the left occipital condyle was missing. Part of the posterior left parietal was exposed. A fragmentof the left temporal was preserved. A thin circular wall of bone formed the outer surface of the broken auditory bulla. The jugular foramen was present like a remnant of bone separated from the rest of the temporal and auditory bulla. The bone exposed behind the bulla could possibly be the posterior end of the zygomatic process. The measurements in (Table 5.2).

Table 5.2 Measurements of the skull of Naga Mas fossil.

	Skull (only posterior visible)	
12	Height of occipital triangular	52.5
13	Height of foramen magnum	26.8
14	Breadth of foramen magnum	36.9
15	Breadth of occipital condyles (left side not preserved)	64.2

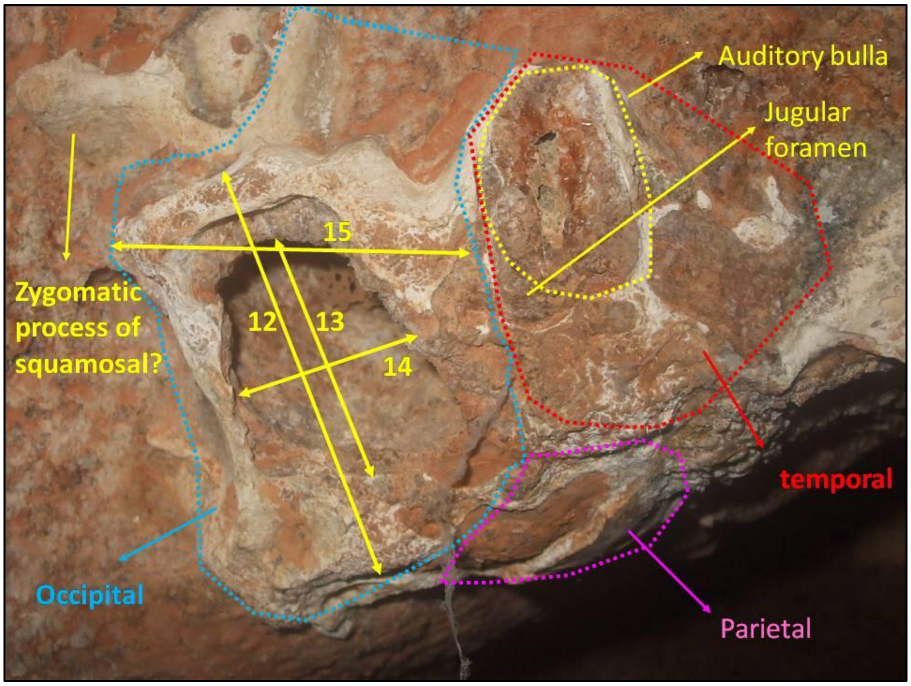


Figure 5.17 Close up photo of the skull of Naga Mas fossil.

C. Scapula (Figure 5.17)

1. Right Scapula (Figure 5.17, A)

Only the anterior part of this scapula was exposed forming a clearly marked outline of about 2/3 of the whole length of the scapula, No useful measurements could be taken from this scapula.

2. Left Scapula (Figure 5.17, B)

Only the ventral side of the proximal end was exposed closely attached to a group of vertebrae (possibly, cervical and anterior thoracic?) and both the left humerus and left ulna. The measurements in (Table 5.3).

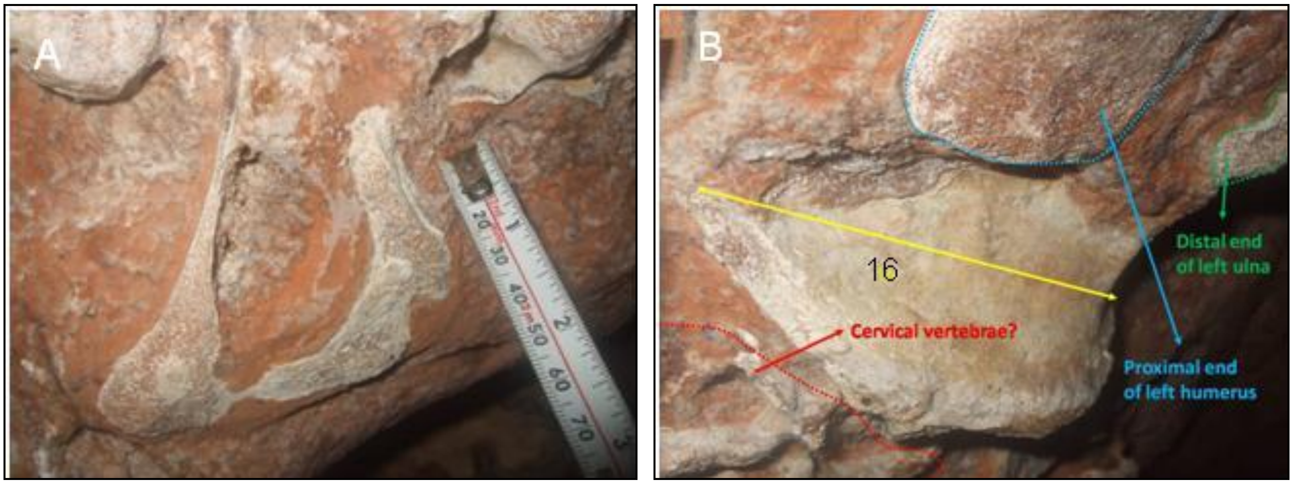


Figure 5.18 Close up photo of right scapula (A) and left scapula (B) of Naga Mas fossil.

Table 5.3 Measurements of the left scapula and right humerus of Naga Mas fossil.

	Scapula (Left)	
16	Breadth	97.7
	Humerus (Right)	
17 (a) (b)	Proximal end (right)	 42.0 44.6

D. Right humerus (Figure 5.18)

Only the oval shaped proximal head was exposed with a small part of the diaphysis protruding out of the matrix. The measurements in (Table 5.3).

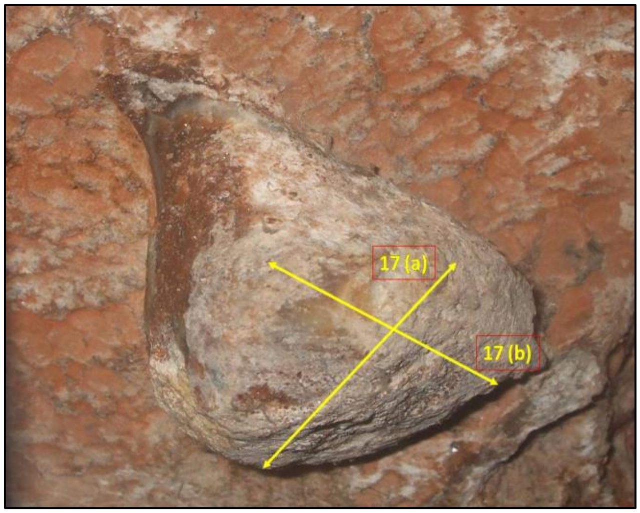


Figure 5.19 Close up photo of right humerus of Naga Mas fossil.

E. Rib (Figure 5.19)

Part of a rib between the right humerus and left scapula was exposed

F. Vertebrae (Figure 5.19)

A group of six vertebrae, possibly cervical and anterior thoracic, was partially exposed.

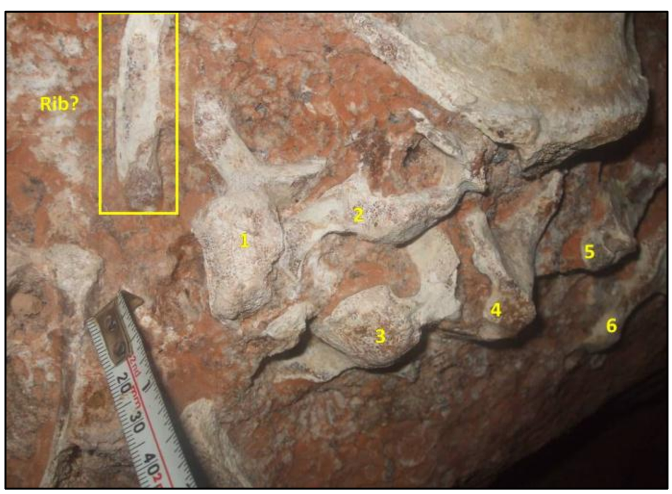


Figure 5.20 Close up photo of rib and vertebrae of Naga Mas fossil.

G. Left humerus (Figure 5.20)

The bone is exposed across its whole length of it possibly posterior surface but uncertain because the olecranon fossa is not visible. The surface of the whole disphysis and articulate surface of its proximal end (Figure 5.21**)** was eroded and the cavity of the former filled with brownish red crystalline cave deposit. The articulate surface (trochlea) of the distal end (Figure 5.21**)** remained relatively intact except for the posterior part (# 19) the remainder of the bone was in good condition. The measurements in (Table 5.4).

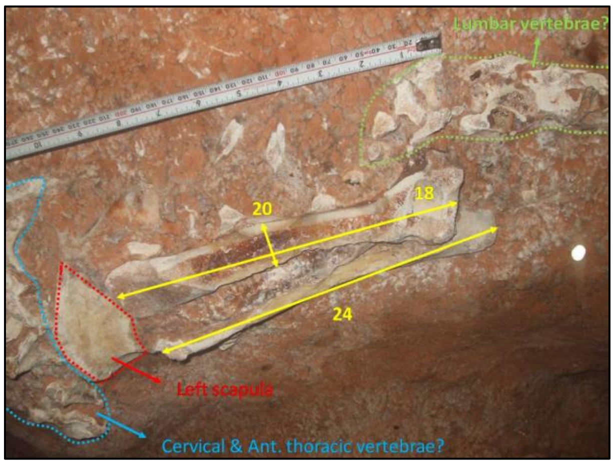


Figure 5.21 Close up photo of left humerus and left ulna of Naga Mas fossil.

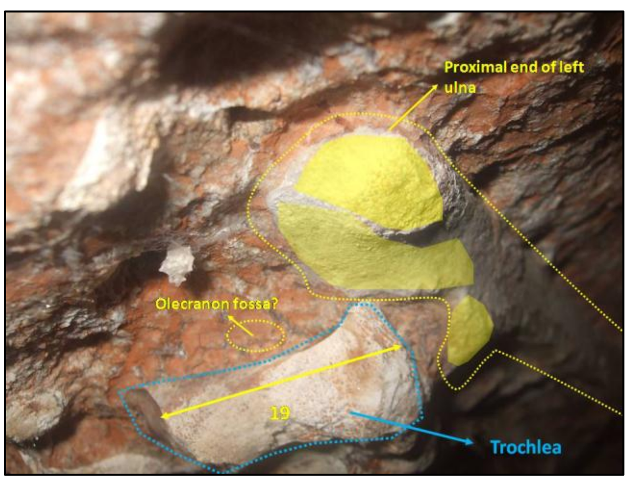


Figure 5.22 Close up photo of the proximal and distal end of the left humerus of Naga Mas fossil.

Table 5.4 Measurements of the left (humers, tibia, and ulna) of Naga Mas fossil.

	Humerus (Left)	
18	Greatest length (left)	233.6
19	Width at distal head (left)	49.0
20	Diameter at mid shaft (left)	29.2
	Tibia (Left)	
21	Width at proximal head	47.4
22	Breadth of bone below proximal head	24.1
23	Minimum length	180.7
	Ulna (Left)	
24	Greatest length from olecranon process to distal head	248.4

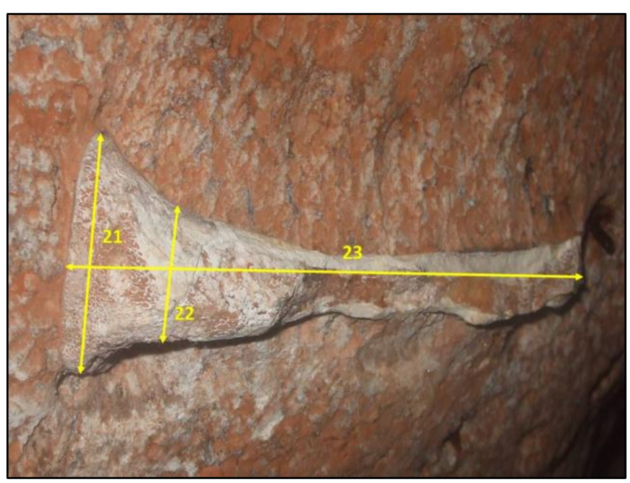
H. Left ulna (Figure 5.20)

This bone was exposed across its whole length and preserved more or less parallel to the left humerus. It was better preserved without exposing the bone cavity but distal end was missing. The proximal end was well-preserved near to the distal end of the left humerus. The measurements in (Table 5.4).

I. Left tibia (Figure 5.22)

This bone was exposed across its whole length but with its distal end lost. The proximal end and immediate part of its diaphysis was well-preserved. The facing surface of the remaining parts of the diaphysis had eroded away exposing the bone cavity filledwith brownish red crystalline cave deposit. The measurements in (Table 5.4).

Figure 5.23 Close up photo of left tibia of Naga Mas fossil.



J. Vertebrae Figures 5.23 (A & B)

A group of six vertebrae, possibly lumbar based on their size, was preserved.

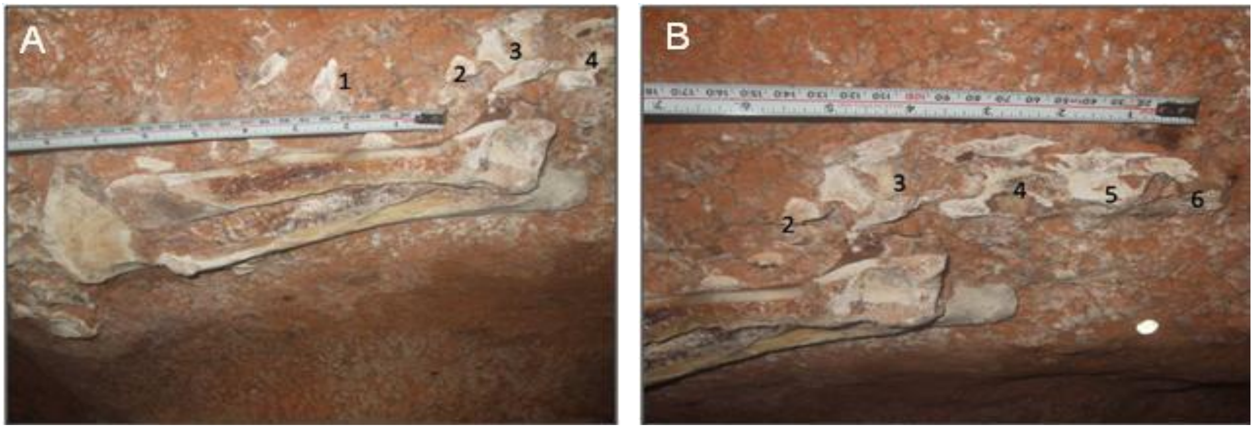


Figure 5.24 (A & B) Close up photo of a group of six vertebrae of Naga Mas fossil.

K. Pelvises (Figure 5.24)

Most of the parts had been eroded away and many features were lost so no useful measurements could be taken.


Figure 5.25 Close up photo of the pelvises of Naga Mas fossil.

All these measurements mentioned above were compared with others from different sources like measurements of *Panthera tigris* and *Panthera pardus* from the Natural History Museum (London) and measurements of a cast for a skeleton of the Naga Mas fossil from the Department of Museum Malaysia at Putrajaya, in addition to comparative measurements from publications like Hooijer (1947b).

5.3.5 Discussion

Since the first discovery of the Naga Mas fossil, many have speculated on its identity from Tiger to modern Lion or Serow or Bear without any definite conclusion and certain age.

In this study, the dating is based on the U-series age for Sample 2 flowstone that exceeds 500 ka which means that it is older than the limits of the technique. This gives a minimum age of 500 ka for the flowstone that is older than the fossil and sediment enclosing it. There was not enough material for an OSL result for Sample 1that buried the fossil so the age is unknown. If we accept that the sediment was deposited later then the sediment is younger than 500 ka (the exact age is indeterminable) and the flowstone is older than 500 ka. This result has opened possibilities for future work on age determinations.

The supracondyloid foramen exposed on the distal end of the humerus (Figure 5.25), as seen in the cast of the Naga Mas fossil in the Department of Museum Malaysia at Putrajaya, is only present in Felids (Schmid, 1972). This feature together with other observations on the post-cranials that characterize the Felids such as: the first lower molar (lower carnassial) in Felids having two blade- like cusps like knife blades forming the cutting shears with the upper carnassials, similar with that in the Naga Mas lower molar (Figure 5.26) confirms it is a Felid and not a Canid (Dog) where the lower carnassial has two or one cusp like in *Cuon* with very long and distinctive talonid typical to Canid or torpedo shaped as in Bears or hypsodont shaped with distinct lobes as in Serows. Some

Felid individuals have been reported to have supernumerary tooth behind the lower carnassialsas (Miles & Grigson, 1936) observed in the Naga Mas fossil represented by a simple conical crown tooth with single root (Figure 5.26).

These characteristics together with the measurements support the interpretation that the Naga Mas fossil belongs to Felidae and not Ursidae (Bear) nor Canidae (Dog) nor Bovidae (Serow). It is a cat that is intermediate in size between the Tiger *Panthera tigris* and the Leopard *Panthera pardus* and classified as *Panthera* sp. until further studies in the future can hopefully identify the species.

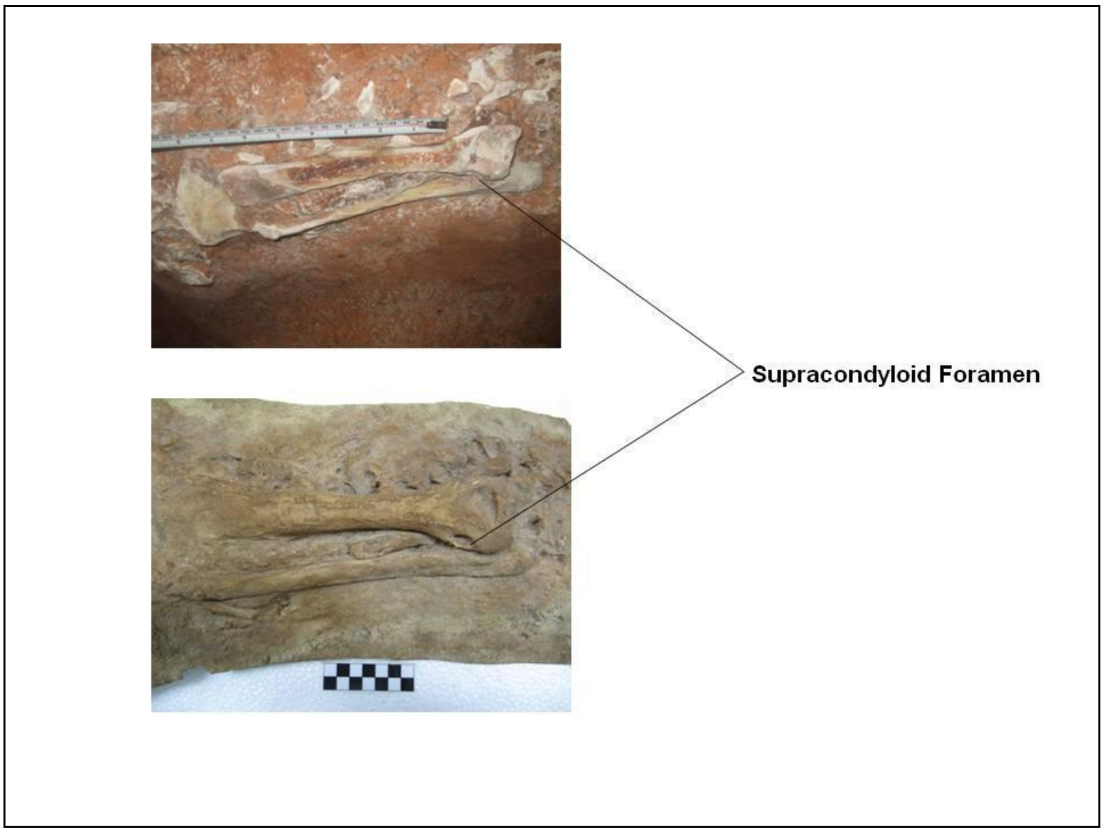


Figure 5.26 The supracondyloid foramen exposed on the distal end of the humerus of the Naga Mas fossil (top) and in the cast of this fossil (bottom).

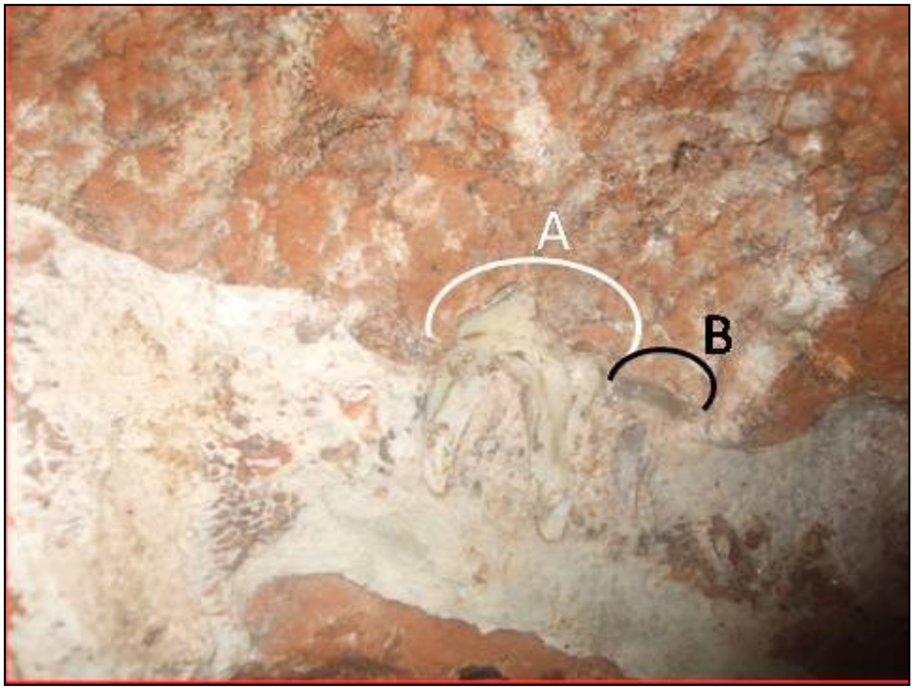


Figure 5.27 The first lower molar (lower carnassial) (A) and the supernumerary tooth behind (B) observed in the Naga Mas fossil.