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NEW DISCOVERIES OF AN EXTINCT GIANT PANGOLIN (*MANIS* CF. *PALAEJOVANICA* DUBOIS) AT NIAH CAVE, SARAWAK, BORNEO: BIOGEOGRAPHY, PALAEOECOLOGY AND TAXONOMIC RELATIONSHIPS

Philip J. Piper, Ryan J. Rabett and Earl of Cranbrook

ABSTRACT

Early in 1960, D.A. Hooijer received three large *Manis* sp. bones recovered from archaeological excavations underway in the West Mouth of Niah Cave, Sarawak, Borneo. Hooijer compared the fossils from Niah with equivalent specimens from both the giant extinct *Manis palaeojavanica* of Java and the modern *M. javanica*. He concluded that there was little difference in the morphology of the bones from the Borneo and Java specimens, and thus attributed the skeletal elements from Niah to the extinct form described by Eugene Dubois, *M. palaeojavanica*. During new investigations of the animal bones recovered during the 1950's and 1960's excavations at Niah Cave the authors identified a further five skeletal elements of this rare fossil vertebrate in assemblages from late Pleistocene deposits. Comparisons of the new skeletal elements from Niah with fossil *Manis* and *Macrotherium* remains from Java and India suggest that the palaeogeography of the large pangolins of Asia is more complex than Hooijer envisaged. This paper describes the new *Manis* sp. bones from Niah cave and discusses the palaeobiological and taxonomic relationship between *Manis palaeojavanica* from Java, the *Manis* specimens discovered in Borneo and the Late Pliocene Indian *Pholidota* in light of these new discoveries.

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THE FOSSIL PHOLIDOTA OF SOUTHEAST ASIA AND INDIA

In 1907 Eugene Dubois published the results of a study on a collection of *Manis* bones discovered at Kendoeng Broeboes (=Kedung Brubus) in central Java (Dubois, 1907: 455; 1908: 1262), associated with a Middle Pleistocene vertebrate fauna. A total of 28 bones found within a few metres of each other probably represented the remains of a single individual. The skeletal elements included parts of the skull, atlas, radius, ulna, femur, and tibia, as well as caudal vertebrae, phalanges, an astragalus, metacarpals, metatarsals and calcaneus. Upon comparison with extant *Manis* forms, Dubois concluded that the bones from Kedung Brubus were morphologically most similar to the scaly anteater of Malaysia, *Manis javanica*. However, the appendicular elements from the archaic form of *Manis* were at least two and a half times the length of homologues in the modern *M. javanica* (see Dubois, 1926a, b), and, as a result, he named the extinct giant anteater from Kedung Brubus, *Manis palaeojavanica* (Dubois, 1907). Hooijer (1947) subsequently increased the geographical range of *Manis palaeojavanica* with the discovery of a further large femur from the Middle Pleistocene site of Tjitaroem (Citarum) valley, west of Batoedjadar (Batuajar), western Java. A later find of a metacarpal IV, from Gunung Butak, near Kedung Brubus, although not of comparable large size, was also attributed by Hooijer (1974) to *Manis palaeojavanica*. At all these Javan Middle Pleistocene sites, this giant species was the only pangolin present.

Hooijer (1947) referred to a 2nd phalange of the third or middle digit of the manus of a large Pholidota from Late Pliocene deposits in the Sind district of India recorded by Lydekker (1876: 64-65). Lydekker (*ibid.*) had reported that the 'very characteristic' bone was in many respects very similar to the same element in extant *Manis indica*, except in dimensions, being twice the size of the extant species. Lydekker attributed the specimen to a new species, *Manis sindiensis*. A few years later, and after comparing the specimen with the same element of the Late Miocene European large-bodied edentate *Macrotherium giganteum*, Lydekker (1886: 50-51) reassigned the specimen to the latter genus, as *Macrotherium sindiensis*.

As one of the leading authorities on Southeast Asian fossil remains, D.A. Hooijer was sent, over a number of years, parts of a vertebrate faunal assemblage recovered during excavations in the Great Niah Cave, Sarawak, Borneo. In 1960 he received material that had been excavated from the deepest deposits at the site – radiocarbon-dated in the 1950s to *ca.* 40kya. This date has recently been confirmed during renewed investigations at the site (Barker *et al.*, 2002a, 2002b, 2007; Rabett, Piper and Barker, 2006). The assemblage sent to Hooijer included three very large *Manis* bones: a right 4th metacarpal and two subterminal phalanges, of the manus and pes respectively. After comparing the fossils from Niah with equivalent specimens of *Manis palaeojavanica*, he concluded that there was sufficient morphometric similarity between the Java and Niah specimens to assign the latter to the same species, *M. palaeojavanica* (Hooijer, 1961). Significantly, remains of the extant species *Manis javanica* were also found at the same stratigraphic level of the West Mouth excavation, confirming that the two species coexisted at Niah in the Late Pleistocene (Hooijer, 1963).

This paper reports on further discoveries of this large *Manis* within the Niah Cave faunal assemblage and discusses the possible taxonomic and biogeographic relationships between the fossil Pholidota of Borneo, Java and India.

THE NEW FINDS OF *Manis* sp. FROM NIAH

As part of an ongoing research project analysing parts of the faunal assemblages from Niah Cave excavated in the 1950's and 1960's, the authors have identified five more skeletal elements of the large *Manis* (Table 1). These bones were recovered from a deposit containing a considerable number of remains of the typical modern rainforest vertebrate fauna of Island Southeast Asia (see Cranbrook, 2000). Modification indicative of butchery, calcined and burnt fragments indicate that the bones of large mammals and reptiles, including the *Manis* specimens, were accumulated as a result of human predation (Barker *et al.*, 2007; Rabett, Piper and Barker, 2006).