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INTRODUCTION

Under *Elephas indicus*, the Sarawak Museum register (p. 350) records a past holding of two skulls, without tusks, of the Asiatic elephant (now *Elephas maximus*) collected in North Borneo by H.H. the Rajah and H.W. Crocker, respectively, together with three isolated molars without provenance, and the disarticulated skeleton and mounted skin of a juvenile male from South China. Notes on the opposite page refer to a fossil molar found in a cave at Bau by a former Curator [R.W.C.] Shelford which, on 22 Sep. 1926, could not be located by a later Curator, E. Banks, but was subsequently found ("in Mus.") on 24 Dec. 1929 (Appendix A). Unfortunately, none of these specimens is any longer present in the Museum.

The earliest written record of elephants in Borneo was also the first reported European contact. When, in 1521, the remnants of Magellan's Spanish-backed circumnavigation reached Brunei, the chronicler of the voyage, Antonio Pigafetta, recounted that the delegation from the flagship *Victoria* was conveyed to and from the ruler's palace on elephants caparisoned in silk (Stanley of Alderly, 1874: 110 – 117, quoted by Bastin & Winks, 1966: 38 - 42; Harrisson & Harrisson, 1971: 29-30; Nichols, 1975). This custom had been discontinued by the time later visitors reported on their experiences of Brunei: neither Forrest in the 1770s (Forrest, 1780) nor James Brooke and his companions in the 1840s (Mundy, 1848) saw elephants at the royal court. At the other extremity of Borneo, Knapen (2001), quoting Groeneveldt (1880) and Schwaner (1853-54), stated that, according to a Chinese source, the sultan of Banjarmasin used to ride an elephant. The origin of these royal elephants was not explained.

The status and taxonomic distinctiveness of the elephants of Borneo has subsequently been controversial. In the 19th century, zoological exploration of Borneo established that wild elephants occurred naturally in a restricted region of the northeast, in what is now eastern Sabah and northern East Kalimantan (summarised by Medway, 1977). Within that area, the population was sufficiently large for marauding elephants to be a nuisance to pioneer planters (Pryer, 1881). For the following century, the known range of the elephant population remained broadly within the same bounds (de Silva, 1968). Payne *et al.* (1985) suggested that this distribution reflected the combined constraints of the natural availability of minerals and prolonged hunting pressure.

Shelford (1899) interpreted the Bau fossil as secure evidence that the Asiatic elephant "was once an indigenous inhabitant of Borneo". But he also believed that, "after lingering on for some time", this original population had become extinct, and that the existing elephants of the northeast were descended from "some pairs which were introduced some years ago, certainly within the memory of living men. These pairs were presented by a Sultan of Pahang ...and, after they had been kept in semi-captivity for a year or two, were turned loose into the jungle". His successor E. Banks (1931: 60; 1949: 80), on the same evidence, and Davis (1962), on the grounds of Koenigswald's (1958) mistaken identification (below), believed that the existing elephant population was indigenous. Other 19th century authors, Dutch (Müller, 1839-40; Jentink, 1884) and British (St John, 1862, vol. 1: 95-96; Pryer, 1881), accepted the local tradition that these elephants were not native but descended from introductions.

Shelford's version (above, and repeated by Poulton, 1916: 41) was one of several variants. Other sources attributed the release to a Sultan of Sulu (who controlled an extensive area of northeastern Borneo prior to its cession to the North Borneo Company), with one of two motives: either to found a population of elephants that would, by their presence, demonstrate his sovereignty over the territory (Harrisson & Harrisson, 1971: 30); or to divert a gift of elephants that would otherwise have been unwelcome additions to

the existing nuisance stock on his own island (St John, 1862, vol. 1: 95). On a visit to the island, St John (1862, vol. 2: 243) was reinforced in his opinion that Sulu was the origin of Borneo elephants by hearing confirmation that, "within the remembrance of the oldest men then alive", feral elephants had indeed been found in that island.

Opinion was divided on the taxonomic position of the Borneo elephants. Chasen (1940: 190), who considered that the Sumatran elephant was distinct from the continental Asian form, wrote: "from the scanty evidence available the Bornean herds, descendants of an introduced stock, seem to resemble the continental form rather than *sumatrensis*", and placed Bornean elephants with Peninsular Malayan in the subspecies *Elephas maximus indicus* Cuvier. Pocock (1943) disagreed and, from his study of specimens in the British Museum (Natural History), allocated all Sundaic elephants, including those of Borneo, to the subspecies *Elephas maximus sumatrensis* Temminck. Meanwhile, Hubback (1942) had implied that the Borneo population was distinctive, stating that "many, possibly most of the mature male elephants in Borneo have very straight tusks and do not conform with the usual curved tusks of *Elephas maximus*." On the basis of this statement, in a revision of the taxonomy of Asiatic elephants Deraniyagala (1950, cited in Deraniyagala, 1951) described a subspecies *Elephas maximus borneensis*, taking as his type an illustration in the *National Geographical Magazine*. This name was synonymised with *Elephas maximus indicus* by Davis (1962) and, later, by Corbet & Hill (1992: 240), who again noted that the Bornean population was "possibly introduced".

Any doubt of the distinctiveness of Borneo's wild elephants was removed when Fernando *et al.* (2003) published mtDNA analysis and microsatellite data indicating that the extant population is derived from Sundaic stock but has undergone independent local evolution for some 300,000 years since a postulated Pleistocene colonisation. Shim (2003), however, has re-opened the debate by suggesting that the introduced Sulu elephants and the north-east Borneo population, if derived from them, might be descended from the now extinct Asiatic elephant of Java which was named *Elephas maximus sondaicus* by Deraniyagala (1950, in Deraniyagala, 1951: 50), describing it as

a “tusked race of normal size” and choosing as type an illustration of a carving on the 8-9th century Buddhist monument of Borabudur. Although the validity of the name may be questionable¹, this ancestry could explain the level of separation indicated by genomic evidence.

In such cases, a combination of historical and palaeozoological records may provide evidence to resolve contemporary biogeographical uncertainties (Lyman, 2006; Cranbrook & Piper, 2007a). In this note, accordingly, we review the history of trade and transportation of elephant in the region. We list all instances of fossil elephant remains discovered in Borneo, both within and outside the present range of the wild population, including two previously unreported discoveries: a molar said to have been found in Niah caves, Sarawak; and parts of the appendicular skeleton found in alluvial soil at Banjarmasin, South Kalimantan. Archaeological records from Java confirm that the elephants existed on that island well into the historical period of postulated introduction to Sulu. We therefore conclude that the traditional story remains a valid possibility, *i.e.*, that elephants from Java were transported first to Sulu, where they became naturalized and subsequently provided the founder members of the existing population of northeast Borneo.

A HISTORY OF ELEPHANT DOMESTICATION AND TRANSPORTATION IN THE REGION

Wild elephants have been caught and tamed for more than 3000 years. In Asia, war elephants from India are known to have been part of the army of king Darius of Persia, used in battle against Alexander the Great (known in S. E. Asia as Iskandar Jaya) in 331 BC. At other times elephants were frequently used in front-line attacks, as well as for carrying baggage (Clutton-Brock, 1981: 119). They thus became symbols of pageantry and power throughout the East.

The first elephant at the court of a Chinese ruler was a single animal sent to Emperor Wu in 121 BC. Later, the Mongol conqueror of China, Kublai Khan, was famed for the large number of elephants

in his possession, the nucleus of his stock being formed by 200 animals captured from the Burmese in 1277 (Laufer, 1925: 18). Later Emperors continued to keep elephants for ceremony and show. The envoy of the Russian Czar in 1692 – 95 reported that the herd was maintained by annual tributary gifts from the king of Siam (Thailand). Lord Macartney, ambassador from Britain in 1792, observed that the Imperial elephants were smaller than those of Cochin-China, and were imported “from the neighbourhood of the equator”. In the 19th century, elephants continued to be kept in their own palace (Siang Fang) in Beijing (all information from Laufer, 1925).

In carvings on Borabudur, Java, caparisoned war elephants are accurately represented, implying direct familiarity by the artist (Sivaramamurti, 1961: pls XXI, XXV). Later, in the Muslim states of the Malay peninsula and islands of the East Indies, elephants were held in high esteem and there was a connection between these animals and royalty (Andaya, 1979: 401). In 15th century Malacca, for instance, the Sultan was normally borne ceremonially on an elephant (Wilkinson, 1935). The Malay elephant harness consisted of a pair of panniers so that, when confronting the Portuguese attack in 1511, Sultan Ahmad was counterbalanced by a scholar, Machdum Sadar Jahan, with a driver on the elephant's head and an official on its rump (*Sejarah Melayu* trans. Brown, 1952: 162-163). In Aceh, too, the Ruler kept a few elephants for state purposes (Marsden, 1811: 116).

Elephants were appropriate gifts from one ruler to another, or to a person of high standing, and it was customary to transport them by sea. Jolo, the port city of Sulu island, was a major regional centre of maritime trade from the pre-Islamic period (*i.e.*, before 1450 AD) until the 17th century, ranking in importance with Brunei (Saleeby, 1908: 137). Sulu forces attacked and sacked Brunei in 1368, but later apparently accepted the suzerainty of Majapahit, *i.e.*, the Hindu rulers of Java. The Sulu *tarsila* records that two elephants from the Raja of Java were given to the ruler, Raja Baginda, about 1395. These animals were reputedly the founders of a feral population at the western end of the island (Saleeby, 1908).

Sea-borne transportation of elephants continued in later centuries. For instance, in 1641, a Dutch merchant, Jan Hermansen, eager to trade tin in Perak, shipped four elephants from Kedah as a gift to the Sultan (Winstedt & Wilkinson, 1934: 39); in 1693, the ruler of Perak sent an elephant to the ruler of Johor, and in 1752 the Dutch governor of Batavia ordered elephants from Perak to be sent to the Susuhunan of Java (Andaya, 1979). There were substantial exports to the Indian subcontinent. Originally writing in 1783, Marsden (1811: 176) reported formerly a "considerable traffic" in live elephants from Aceh "to the coast of Coramanel or *kling* country, and vessels were built expressly for their transport". Sultan Taj al-Alam of Aceh sent eight elephants to an envoy from Gujerat (Andaya, 1979) and in 1678, among regulations imposed by the Dutch East Indies Company, was the requirement to charge dues of 10% on elephants bought in Perak by "for the purpose of exporting them to Bengale or Coramandel, as we did last year in the case of the yacht *Chaffarie* of the Nabob Mamet Aminchan" (Winstedt & Wilkinson, 1934: 40). In the Malay states, this trade declined with the disintegration of the Moghul empire and the adoption of European tactics of warfare by the Indian princes (Marsden, 1811). None the less, buyers from India continued to source elephants from peninsular Malaysian states in the late 19th century (Andaya, 1979).

The presence of elephants on Sulu island was known to the Spaniards in Luzon. In 1579, the governor of Manila sent an expedition to Mindanao under Captain Gabriel de Ribera, with instructions also to procure two or three tame elephants from the Sultan at Jolo (Saleeby, 1908: 168). The existence of wild-living herds was reported by Thomas Forrest, who travelled in the region 1774-76: "Here are wild elephants, the offspring, doubtless, of those sent in former days from the continent of India, as presents to the Kings of Sooloo. Those animals avoid meeting horned cattle; although they are not shy of horses.... After harvest, the Sooloos hunt the elephants and wild hogs, endeavouring to destroy them" (Forrest, 1780: 323-324). John Hunt (1837), who apparently lived on the island for several months around 1814, also reported that "Sulo is the only island of the Philippines that breeds the elephant. The islanders neither tame them nor use them. They were, it is said,

originally imported from Banjar [masin] and formerly used as in Siam, Cambodia, Pegu &c. for religious purposes. Formerly this island was overrun with these animals, but the terrible destruction they occasioned to the plantations, and being no longer venerated under their new religion², have induced the natives to destroy them whenever they could meet with them: and they have instituted a grand hunting match every year, after the grand crop is collected in." Within a few decades of Hunt's visit, the people of Sulu had apparently succeeded in exterminating their elephants: James Brooke and Captain Henry Keppel failed to mention these marauding herds in the account of their visit to Jolo in December, 1848 (Keppel, 1853).

Despite the early records of royal elephants in Brunei and Banjarmasin (above), there was no tradition of capturing and taming local wild elephants in Borneo. Much later, when the value of elephants in lumbering and other heavy tasks was recognised, the colonial administrators of North Borneo did not turn to the state's own population but bought elephants elsewhere. The first recorded importation into eastern North Borneo occurred in 1899, when two elephants were landed at Sandakan to work on the construction of a trans-Borneo telegraph line. There are no records for the intervening period, until the use of working elephants in lumbering was revived between 1949-52, with the importation of 10 elephants from Thailand, of which five died and five were apparently returned to their country of origin around 1955 (Ibbotson, 2003).

In Sarawak, in 1938 Borneo Company Ltd (BCL) brought in two cow elephants together with their Thai riders, for use in forest operations above the Pelagus rapids in Upper Rejang. Unfortunately, one of the elephants slipped down a bank and was strangled in a creeper. The other survived for several years and BCL was negotiating for another 12 elephants when the war broke out (J. Ritchie, in prep.). After the war, BCL resumed elephant logging in 1951. At the time of post-war reconstruction, the export of elephants was prohibited from India, Burma and Thailand, so the company bought five beasts, aged 11 to 17 years, from Chipperfield's circus in U.K. After 52 days at sea, including trans-

shipment at Singapore, these unfortunate animals were slung ashore at Sarikei, and promptly swam across the river and got bogged on the opposite bank (Longhurst, 1956: 109-110).

These elephants were set to work in the BCL concession in the middle Rejang. The herd ultimately reached 22 in number, and local Iban learnt the skills of elephant management (Plate V, from Sarawak, 1953). However the operations did not last long and in 1955 BCL retired to the swamps to extract the more profitable ramin (Longhurst, 1956). Four elephants had died of an undiagnosed illness, and the remaining herd of 18 was sold to Kong Thai. In 1960 eight animals were still working, the rest having died. The Lee Seng Thai group took over and, by 1966, five surviving elephants (including some of Chipperfields) were still working in the Sungei Merirai (J. Ritchie, in prep.)

The provenance of the working elephants of Sabah and Sarawak was thus varied, and none derived from the local Bornean stock. The fate of the casualties is mainly unknown, apart from two prominent examples: the pair of tuskless skulls of a male and female on display at the Sarawak Museum Kuching (Plates VI, VII) familiarly known by their Iban description, *pala antu gerasi* (= ogre's skulls) [Reg. No: SMZ 1960a&b]. The associated notice relates that these elephants were brought from Thailand in the early 1950s and used by the Borneo Company to extract timber in the hilly country of the Bah River, Belaga District. After being obtained by the museum, the skulls were decorated by Kenyah artists from the upper Kayan river, East Kalimantan. The disposal of the post-cranial skeletons of these two elephants is not known. Clearly, there is a risk that the bones, or extracted teeth, of any of these alien domesticated casualties, if discovered accidentally, might be mistaken for the remains of native, indigenous animals.

Independently of the use and transportation of domesticated elephants, there was of course a long-standing world trade in ivory. According to Laufer (1925: 17) during the middle ages (*i.e.*, 12th century) ivory was imported into China, chiefly by Arabs, from several states in the Malay peninsula, Java and Borneo, the eastern

coast of Sumatra, southern India and the Somali coast of eastern Africa. In the 19th century, St John (1862, vol. 1: 96) found a flourishing local trade across northern Borneo, with many tusks brought from the Kinabatangan area of Sabah to Labuan. While describing how one man had killed many elephants armed only with a spear, he still considered that dead bodies found in the forests were the main sources for the ivory trade. It is plausible that isolated molars were also items of interest, as they are nowadays, and therefore traded along with ivory, for lesser markets.

THE PALAEOZOOLOGICAL RECORD

Java

In Java, cited by Saleeby (1908) as the origin of the past feral population on Sulu island, dated archaeological specimens confirm the presence of Asian elephants from the period of the last interglacial. For instance, the species is represented in the fauna of Punung A and B (or I and II, of some authors) (Storm *et al.*, 2005) which has been dated, by inference with Punung III, between 128 ± 15 and 118 ± 3 ka³ (Westaway *et al.*, in press, 2007). Elephant remains were also found at Song Gupuh, both at the deepest level 14.7 m below the present-day shelter floor, with an inferred age of around 70 ka, and at levels dated between 12 and 10 ka (Sutikna *et al.*, in press). Still unpublished, the youngest radiocarbon date is 600 BP, *i.e.*, around 1350 AD, at Mauk, just west of Java (courtesy of Rokus Due Awe). This date is clearly within the historic period when elephants were being transported by sea both within the Indo-Malayan archipelago and across the Indian Ocean.

Borneo

In Borneo, by contrast, there have been no authenticated finds of Asian elephant in any controlled excavation, including that at the West mouth of Niah cave, where the archaeological deposit is dated from recent to about 45 ka (Barker *et al.*, 2003). A phalanx found at

the West mouth, Niah caves, was mistakenly attributed to Asiatic elephant by von Koenigswald (1958: 622; see also Davis, 1962: 118) but subsequently re-identified as Malay tapir *Tapirus indicus* by Medway (1961, 1963). No confirmed elephant remains have been found in excavations at Niah, nor at any other site in Sarawak or Sabah (Harrisson & Harrisson, 1971: 29; Medway, 1979: Table 2; Cranbrook, 2000). Even at Madai cave (Bellwood, 1988), within the species' present range in eastern Sabah, no elephant remains were found, although other large ungulates were represented in an early Holocene context: two rhinoceroses, Javan *Rhinoceros sondaicus* and Sumatran *Dicerorhinus sumatrensis* (Cranbrook, 1986), and Malay tapir *Tapirus indicus* (Cranbrook & Piper, in press).

There have, however, been elephant teeth found in caves, and teeth and other skeletal remains discovered in non-cavernicolous contexts, as detailed below.

Cave specimens

Specimens found in caves outside the historic range of wild elephants in northeastern Borneo comprise the following:

1. An isolated upper first molar in the Natural History Museum, London, Department of Palaeontology (reg. no. M10237) presented by H.C. Robinson, Director of the Raffles Museum, Singapore. The attached label notes that this tooth was found in a cavern in Belait District, Brunei (Plates I, II). Hooijer (1972) considered that the high uranium content (9 ± 1 ppm e U_3O_8 , BMNH AS 213) indicated Pleistocene age. Since there are at present no known caves in Brunei, the exact provenance of the specimen is uncertain. Hans Dols (email, 21 May 2007) comments that there have been unverified reports of limestone outcrops seen by adventurous walkers who trekked from Ingei hot springs, Belait District, to Mulu, Sarawak, about 1997. In the tropical environment, where there is limestone there are probably caves.

2. As already noted (above), Shelford (1899) reported the discovery "in a limestone cave at Bau, in Upper Sarawak, of a semi-fossilized fragment of an elephant's molar", thereby confirming to his own satisfaction that there was formerly an indigenous population (see Poulton, 1916: 41). The specimen was seen by Banks, who wrote, "There is in the Museum here part of a fossil molar tooth of an Indian Elephant taken from a crevice in the limestone near Bau in Upper Sarawak; the specimen consists of four and part of a fifth distal sections of the first of the two premolars in the upper jaw" (Banks, 1931: 16; repeated in 1949: 80). This important fossil is no longer present in the collections of the Sarawak Museum.
3. *The Niah molar.* In 1976 Awang Bojeng bin Pengiran Terjudin brought to the Sarawak Museum a molar of an elephant which, he stated, had been given to him before World War II by his late father-in-law, Haji Mohamad Niah, whose grandfather had found it, long ago, while collecting birds' nests somewhere in the Niah caves complex (Lucas Chin, *in litt.*, 22 Dec. 1976). Its identity as an elephant molar was not recognised by its owner, who considered it to be *gigi hantu*, a tooth of some fantastic supernatural entity.

The Niah specimen is a complete left upper first molar, consisting of 13 plates or laminae; this figure is within the range of 11 – 15 laminae in *Elephas maximus*. The tooth length is 155 mm; its breadth at the widest point 61 mm; the height of the tallest unworn plate is 131 mm from the base of the enamel to the tip of the occlusal surface. These measurements, again, are all within the range of the homologous tooth in the modern Asiatic elephant (Roth & Shoshani, 1988).

Its lighter coloration and general appearance suggest that this tooth is much younger than the presumed Pleistocene M10237 (above). The enamel is dirty white, with no more than small areas of brown staining on the worn occlusal surface and dark brown mottling on about 20% of the exposed sides of the laminae. The dentine is dull, pale creamy grey, with some cracking. The

cementum is dull creamy white to chalky white, tending to separate from the enamel on the sides of the tooth but not cracked (Plates II, III). The roots are closed under the seven anterior laminae but open under the six posterior laminae. There are traces of pale, creamy yellow clay soil inside the root spaces, with marks showing that a fine, sharp instrument had been used to scrape out the soil.

The Niah tooth was subjected to a Geiger test at the British Museum (Natural History), the results of which showed that the tooth had not taken up any elements emitting β -radiation. There is therefore no radiological evidence of any great antiquity, although it must be noted that the 'Deep skull' at Niah, confidently dated by other technology at *ca.* 35,000 years (see Barker *et al.*, 2007), also gave no count when subject to a similar test (AS 132) (Theya Molleson, *in litt.* 12 Nov. 1979).

Open sites

While most archaeological attention regionally has focused on caves, elephant remains have also been found in open sites. According to St John (1862, vol. 1: 95) the ivory of commerce in 19th century Borneo was generally procured from dead bodies found in the forest. As already noted, the collections of the Sarawak Museum formerly included three molars, of unknown provenance but presumably from North Borneo, now Sabah (Appendix A). Within the present range of wild elephants, at Bukit Kretam, Sabah, Davis (1962) found an isolated third molar on the forest floor and, in 1983, J. Payne and wildlife ranger Sampoladon Pilik found a single old tusk on the forest floor in the upper catchment of the Tabin River, Sabah.

Museum specimens comprise the following:-

1. Two molars in the Natural History Museum, London (BMNH 76.9.20.18 & .19) which were sent by Hugh Low, resident at Labuan in the 1870s, with a collection of mammals from the Borneo mainland opposite Labuan. From the appearance of these teeth, Günther (1876: 736) deduced that "they had evidently been exposed for a long time to the deteriorating

influence of the weather and, although elephants are no longer found in the immediate vicinity of the west coast, Mr Low ... has no doubt of this animal being indigenous to Borneo, and not merely an importation". Medway (1977: 142), however, reached a contrary conclusion, judging from their condition that both teeth could have been extracted from the jaw of a freshly dead elephant, and had not subsequently been exposed to the elements for any length of time.

2. *The Banjarbaru bones*

The Museum Lambung Mangkurat in Banjarbaru, South Kalimantan, has bones which appear to be those of *Elephas maximus* comprising one whole femur, one whole ulna, a partial ulna (65%), two partial radii (60% and 80%), one partial clavicle (80%), three vertebrae, three pairs of rib bones, and a few bone fragments (Plate VI). Measurements of the femur and ulna compared with those of an adult male Sumatran elephant (Natural History Museum, London, accession number ZD1984.510) show that the former is considerably larger (Table 1) and comparable in size to an adult Indian male elephant.

These bones were obtained in the first half of 1987 from swamp land belonging to Haji Sulaiman, within the boundary of Desa Koanda, about 600 m off Tamban River and 130 metres south-

Table 1: Measurements (cm) of femur and ulna of Banjarbaru and Sumatran male elephants †

FEMUR		GL	GLC	DC	BP	SD
	Banjarbaru	102.0	96.8	12.8	27.00	10.30
	Sumatra	83.7	79.5	9.83	22.50	7.88
ULNA		GL	L1	LO	SDO	SD
	Banjarbaru	77.9	63.9	18.4	11.8	8.0
	Sumatra	64.9	55.0	11.6	10.6	5.7

† Note: GL = greatest length; GLC = greatest length on the condyle side; DC = maximum diameter of condyle; BP = maximum breadth of proximal articulation; SD = minimum diameter of the diaphysis (shaft); L1 = length from base of the olecranon fossa to distal end; LO = length of olecranon; SDO = smallest depth of olecranon.

east from the Wonosari canal (Handil Wonosari, which forms the boundary between Desa Koanda and Desa Damsari). The site is about 15 km west of Banjarmasin city centre, on the west side of the Barito River. Museum records state that the bones were found at a depth of about 250 centimetres during the digging, with hand tools, of a new drainage ditch; and that when found the bones were cream-coloured, turning blackish after a few days' exposure.

A visit made to re-locate the site by J. Payne and others on 21 March 2002 found that the area is swampy, under secondary plant growth, not cultivated, and the 1987 ditch abandoned. A local inhabitant pointed to the site said to have been the location of the bones, at about one hundred metres south of $3^{\circ} 19' 25.5''$ S $114^{\circ} 26' 43.5''$ E. The soil is freshwater alluvium possibly with some salt water intrusion. Although the stratigraphy of these bones is uncertain, their location in a floodplain accreting rapidly, by frequent sedimentation from a massive tropical catchment, suggests that the peaty deposit in which they lay was recent. The creamy-white colour of the bones, when first found, also suggests a rather short period of burial.

DISCUSSION

In naming the Javan elephant, Derinayagala (1951) observed that the subspecies became extinct about the 12th century. This date was evidently an underestimate. Even the latest archaeological date of ~1350 AD is unlikely to have recorded the final extirpation of the elephant of Java. By the end of the 18th century, however, the native population was undoubtedly extinct although imports continued, albeit rarely (Raffles, 1817).

Historical documentation confirms that during this period, and probably earlier, there was sea-borne transportation of live elephants between states of the region, extending as far as China on one

direction and the Indian subcontinent and Sri Lanka in the other. Such shipments could account for domesticated elephants reported at the royal courts of Brunei (mid-16th century) and Banjarmasin, and emphasises the plausibility of the report by Saleeby (1908), that the feral elephants of Sulu island were originally from Java, as a gift between royal personages. It is also compatible with the local tradition that the present population of north-eastern Borneo was descended from imported animals from Sulu, or elsewhere, released near the eastern point of (present day) Sabah.

The most likely explanation for the origin of the Banjarbaru elephant is that it represents the remains of an Indian male, imported to the Banjarmasin sultanate at some date from the 16th century onwards. The later situation is complicated by the importation of working elephants, from the late 19th to mid 20th centuries. For buyers in Sabah and Sarawak, Thailand was the main source of these animals, but the Chipperfield elephants were probably Indian. The skulls of two casualties among these imports found their way to Sarawak Museum. Others might have gone elsewhere, or been broken up into separate teeth for improved marketability.

The molar (BMNH) M10237, supposedly from a cave in Belait district, Brunei, and Shelford's lost fragment from Bau, Sarawak, have both been taken to demonstrate the presence of the species *Elephas maximus* in Borneo in Pleistocene times. Yet, in contrast to Java, archaeological sites in Borneo, covering the past 45,000 years at Niah (Sarawak) and perhaps 15,000 years at Madai (Sabah), have failed to produce any confirmatory elephant remains, although other large ungulates (two rhinoceroses, tapir, wild cattle) are represented. Although undated by any modern method, it is possible that the Bau fossil was of Pleistocene age. It would then confirm the ancient presence of Asiatic elephant in Borneo but not, on its own, show that elephants survived in Borneo through the terminal Ice Age and Holocene climate changes (Cranbrook & Piper, 2007b). The lack of later finds may be insufficient proof, but is compatible with Shelford's (1899) first assumption that an early (Pleistocene) population was exterminated and left no descendants.

Of the isolated elephant teeth found in open country or forest, Low's late 19th century couple of molars from the Borneo mainland opposite Labuan island are not confirmed as prehistoric in date. Given that there was contemporary trade in ivory from eastern North Borneo to Labuan, ultimately for export to China, elephant molars may have been carried, as objects of lesser worth, along with tusks. Among people unfamiliar with elephants (*i.e.*, outside their natural range), the identity of these teeth would have been unrecognised and their unusual appearance, as in recent times, would give them supernatural connotations ("ogre's teeth"). As curiosities, charms or objects of magical power, single teeth might have been transported great distances from their place of origin. Such informal trade could, for instance, account for the deposition of a single tooth in Niah cave, as a charm or value object associated with pagan inhumation. Like the earlier records of isolated elephant molars, the Niah tooth lacks confirmed provenance, but appears not to be of great antiquity.

Even the obviously ancient Pleistocene specimen (M10237) is not beyond suspicion. Purportedly from a cavern in Belait, a district in which no cave is presently known, it too may have been an item of trade. In the 19th century, fossils could be big business, as documented by Tickell (1996). Cranbrook *et al.* (2007) has shown that genuine Middle Pleistocene fossils from Java are traded in modern Sarawak. Eastern merchants and travellers have never been backward to exploit a market, and it is possible that H.C. Robinson was misled by the story of a cave and sold a fossil of alien provenance!

The mtDNA demonstration that the wild elephants of Borneo are distinct from those of two possible source areas, *i.e.*, Sumatra and Peninsular Malaysia, with a genetic history of separation for some 300,000 years, *i.e.*, Pleistocene times (Fernando *et al.*, 2003) is supported by subjective examination of TV footage and photographs of living animals of the Sunda subregion. It appears that the existing elephant of Borneo possesses a relatively longer tail (the distal hairs commonly touching the ground) and a relatively shorter trunk (J. Payne). The feral origin of the Sulu population is undisputed, but the origins of the original introductions are not certain. Given the active

ship-borne trade in elephants within Southeast Asia and between South and Southeast Asia, the tradition that they came from Java is clearly possible, if not probable. The mtDNA of the Borneo elephants, if they did indeed derive from Sulu, could therefore reflect genomic separation of their Javan ancestors. In short, both genomic and morphological differences are compatible with the two alternative conjectures: these elephants may be descended from a population that has been continuously present in Borneo from mid-Pleistocene times or, equally, they may derive, after a period of naturalisation on Sulu, ultimately from importation of representatives of an extinct Javan population. The lack of archaeological specimens in Borneo, as compared with Java, lends support to the traditional story of introduction from Sulu (originally from Java, probably), rather than survival *in situ* in Borneo from the Pleistocene.

In our view, on present evidence, the conclusion that the population of north-eastern Borneo consists of remnant survivors of the extinct Javan elephant – implausible though it may seem at first – is the more likely. If correct, this ancestry does not detract from the significance of the elephant population now found wild (or feral) in the rainforests of Borneo. On the contrary, such a conclusion adds to their conservation significance. If proven, this fascinating story would demonstrate that very small populations of large mammals can be saved from the brink of extinction, despite concerns over inbreeding, by the simple expedient of moving a few individuals, from a seemingly doomed population, to a different and safer habitat.

Notes

- ¹ The Code of Zoological Nomenclature (ICZN 2000) article 72.5.6 rules that the name-bearing type is not the illustration, nor the carving – which is a form of illustration – but the living elephant that was portrayed (if there was one, in fact) !
- ² According to an earlier passage in this account, the people of Sulu were converted to Islam by Sherif Sayed. Ali, originally from Mecca, became the first Muslim Sultan.
- ³ ka = thousands of years before present.

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APPENDIX I

Comparative size of the Borneo elephant.

Since the publication of the genomic characteristics by Fernando *et al.* (2003), with no additional metrical data, it has become commonplace to refer to Borneo elephants as a 'pygmy' subspecies (WWF Malaysia, 2003). Although many elephants in Sabah have been killed by hunters or culled for crop protection and similar reasons, few have been measured in the field, and still fewer preserved as museum specimens. From measurements of culled specimens, de Silva (1968) showed that adult elephants of Sabah of both sexes are similar in height to their counterparts in Peninsular Malaysia. Five measurements of the skull of a fully adult female elephant from Gomantong Forest Reserve, taken by Davis (1962: 119), were slightly smaller (72 – 90%) than comparable dimensions averaged for two Sumatran skulls, but the sexes of the latter were unknown and males could have been included. Taking measurements from males only, Pocock (1943) showed that the condylobasal length of elephants from Negeri Sembilan (Peninsular Malaysia), Lampung (Sumatra) and North Borneo (now Sabah) were similar at 29.5 – 31 inches (75 – 80 cm), and about 20 cm less (i.e., ~80% smaller) than males from India and about 12.5 cm less than males from Sri Lanka. Together, these few available measurements show that, although Sabah elephants are up to one fifth smaller than those from India, they are of similar size to other populations of the Sunda subregion.

Appendix II: Transcripts from the master catalogue of the Sarawak Museum.

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Order Ungulata

(Gajah)

Suborder Proboscidea

Fam. Elephantidae

Genus *Elephas* Linn. = 63 (1766)

Elephas indicus Cuv. = 63.1

" Gajah "

No.	Sex	Date	Dimensions	Locality	Collector	Pos ⁿ in Mus ^m	Remarks
63.11			117.3 x 68 (approx.)	British North Borneo	H.H. the Rajah	Room over office	Skull } zygomatic arches slightly damaged
63.12			103.5 x 60 (approx.)	" " "	H. W. Crocker	" "	
63.13			2 ? 22.9.36 3 molars	? not belonging to these skulls			" } no tusks
63.14	♂			? S. China		Workroom	28 months old Disarticulated skeleton
63.15	♂ ^{juv}			" "			Skin mounted

Lydekker in P.Z.S. 1885 describes and figures a tooth of Mastodon latidens Clift
From Borneo: it was found by Everett near Brunei. The species occurs also in India.

*Shelford – Journ. Malay Br. R.A.S. 1899, No. 32, p. 218 - Notes from Sar. Museum
describes a fossil molar of Elephas indicus from [a] cave at Bau - showing previously
Indigenous -- but don't know what became of the specimen E.B. 22.9.26*

In Mms.

E.B. 24.12.29

[Note: Entries in three different handwriting:- *Original entries.* First modification & notes. *E. Banks' dated notes (1) and (2)*]



Plate I: The Belait molar (M10237) lateral view.

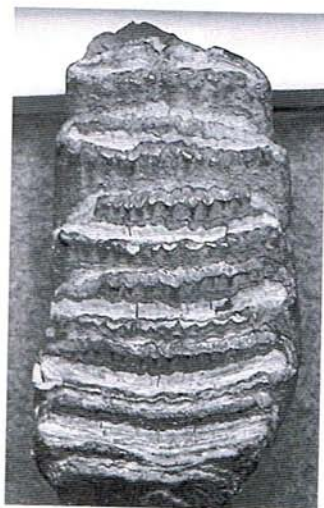


Plate II: The Belait molar (M10237) occlusal view.

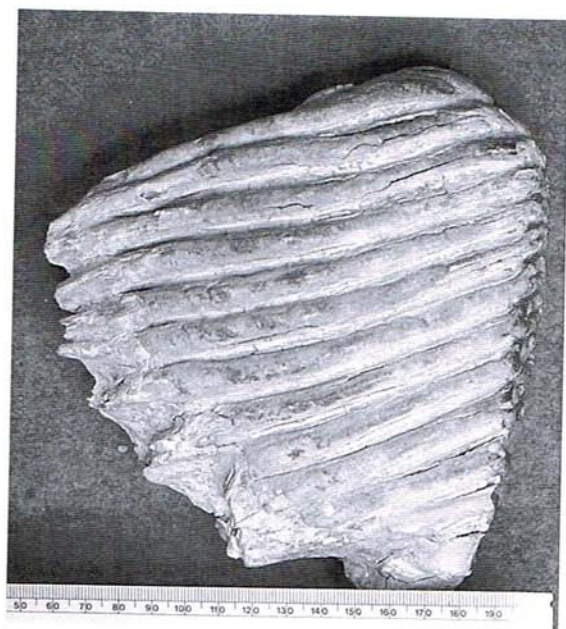


Plate III: The Niah tooth, lateral view.

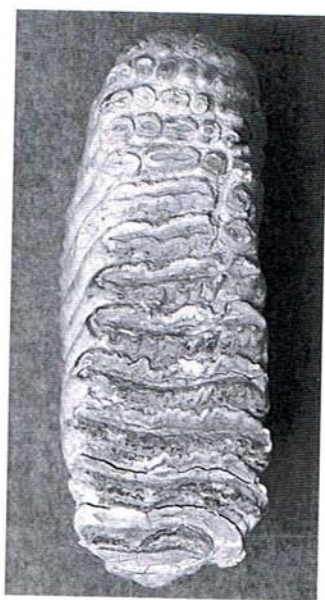


Plate IV: The Niah tooth, occlusal view.

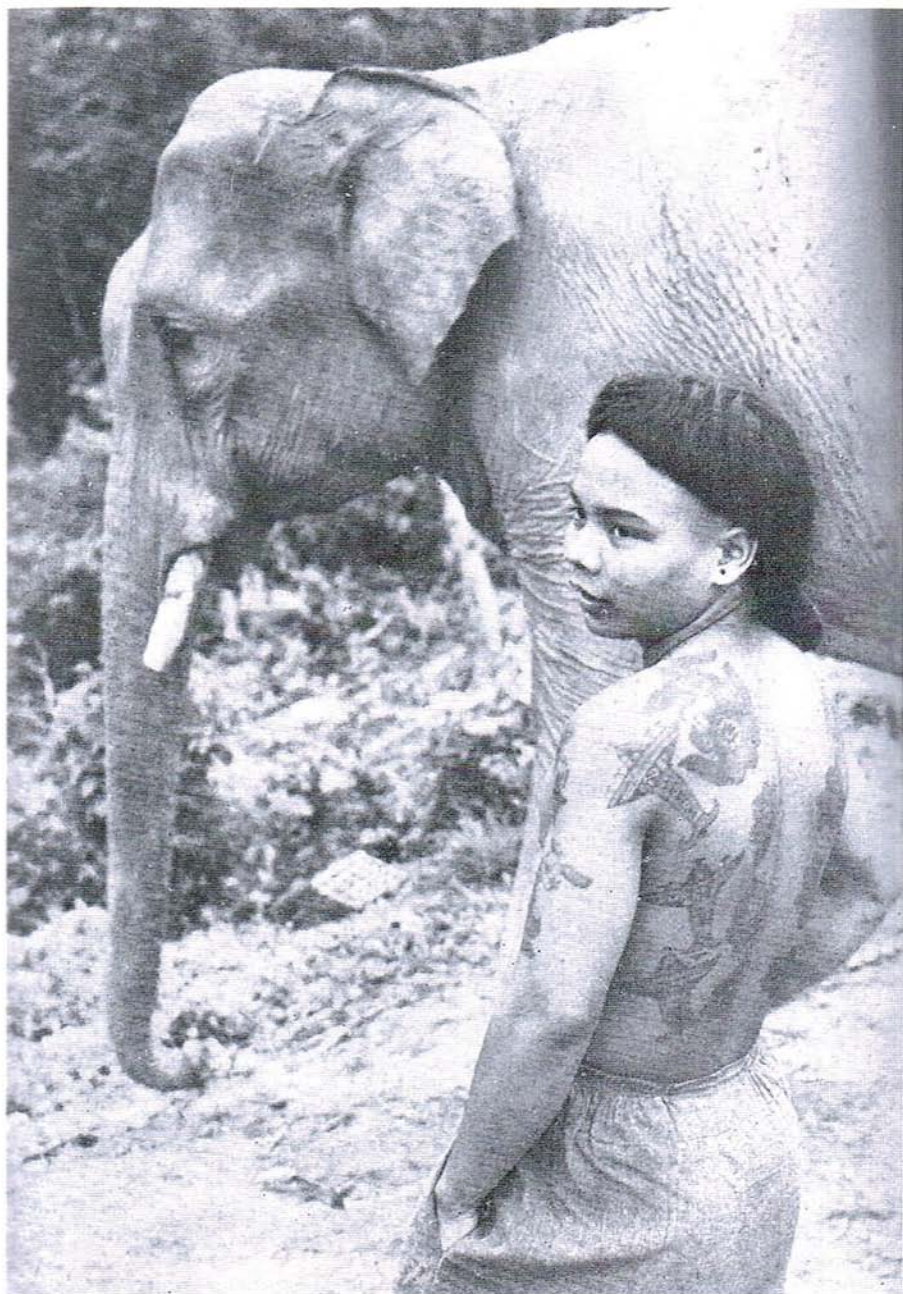
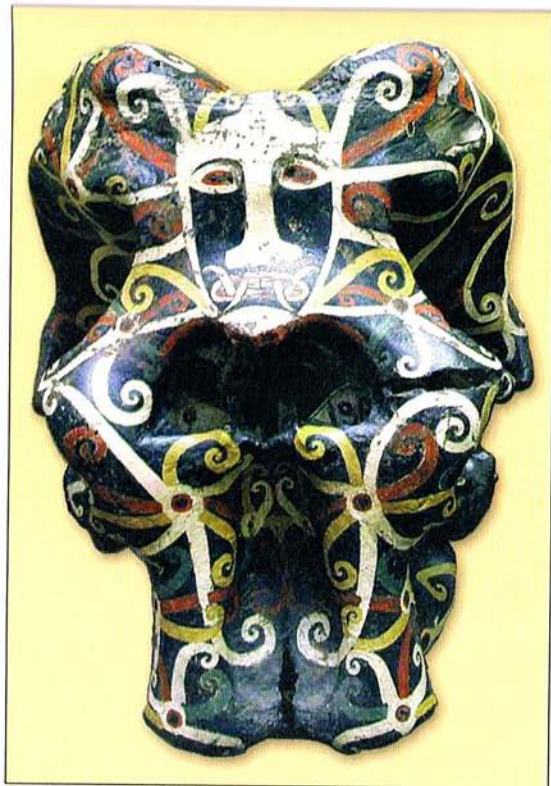


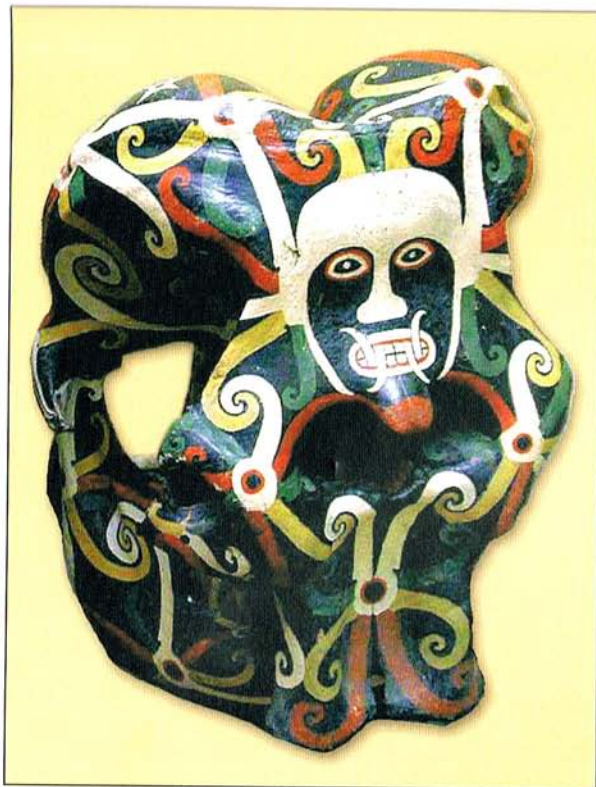
Plate V: "With his Iban driver and friend: one of the elephants used for hauling timber in the Upper Rejang region of the Third Division". Picture & caption from *Sarawak*, 1954, opp. p. 65.



Plate VI: The *Elephas* bones in Museum Lambung Mangkurat, Banjarbaru, South Kalimantan.



Reg. No.: SMZ 1960a.



Reg. No.: SMZ 1960b.

Plate VII: The two decorated elephant skulls at Sarawak Museum (left ♀, right ♂).