SOME REMARKS ON RECENT, PREHISTORIC, AND FOSSIL PORCUPINES FROM THE MALAY ARCHIPELAGO

by

Dr. D. A. HOOIJER
(Rijksmuseum van Natuurlijke Historie, Leiden)

With 20 textfigures

Few fossil remains of rodents have been collected in Java until now, and they have received little attention. In the reports published during his paleontological researches in Java, Dubois twice records finds of *Hystrix* remains, viz., at Pati-Ajam in Japara (Anonymus, 1891, p. 12/13), and in the region between Bangle and Djeroek (Anonymus, 1893, p. 12). In a subsequent paper (Dubois, 1907, p. 454) we find mention of the presence of porcupines in the fossil fauna of Java, but in his review of the latter fauna Dubois (1908) bestows no words upon these rodents. The Selenka Expedition to Trinil secured one tooth, which was figured by Stremme (1911, p. 83, pl. XVI fig. 5) as a right M^2 of a small species of *Hystrix*. Finally a tooth of *Hystrix* from Sangiran II was made mention of by Von Koenigswald (1934, p. 193).

Among the material from prehistoric caves in the Padang Highlands, in Central Sumatra, which were explored by Dubois in the years 1888 to 1890 (Anonymus, 1889-90) teeth of porcupines are prevalent, and almost every tooth or bone in the Sumatran collection bears evidence of the gnawing habits of these animals. We possess hundreds of isolated porcupine teeth, but also a number of rami with the teeth in situ, and a few bones referable to the same animals.

The recent porcupine of Java is regarded by modern authors as a subspecies of *Acanthion brachyurus* (L.) from the Malay Peninsula. The Sumatran form of *Acanthion* is intermediate in size, as in geographical position, between *A. b. brachyurus* (L.) and *A. b. javanicum* Cuvier; it is named *Acanthion brachyurus longicaudum* (Marsden) in the present paper.

The lower porcupine teeth from the Pleistocene of Java in the Dubois collection (registered below as Coll. Dub.) belong to a subspecies of *Acanthion brachyurus* (L.) which is ancestral to the living Javan race and presents the same dimensions as *A. b. longicaudum* (Marsden). The case will be commented upon below. The M^2 figured by Stremme (l.c.) is too small to belong to the same species. It represents a second species of porcupine in the Javan Pleistocene which I identify provisionally as *Thecurus sumatrae* Lyon subsp. [1]).

Recent material examined:

Hystrix leucura Sykes [2])

1. Nearly adult skeleton (M^3 erupted but unworn). Leiden Museum, cat. a. India, from Frank, 1849.

2. Adult skull (M^3 slightly worn). Leiden Museum, cat. b. India.

3. Adult skull. Leiden Museum, cat. c. From the cabinet of Temminck.

Acanthion brachyurus javanicum Cuvier

1. Skull of young (M^2 not yet erupted). Leiden Museum, cat. f. Java.

2. Young skeleton (M^2 worn, M^3 not yet erupted). Leiden Museum, cat. c. Presented by the Zoological Society Natura Artis Magistra at Amsterdam, 21-2-1872.

3. Almost adult skull (M^3 erupting). Leiden Museum, cat. e. Java, from Junghuhn, 1864. Occiput incomplete.

4. Almost adult male skull (M^3 erupting). Leiden Museum, reg. no. 1282. Java. From the Rotterdam Zoological Garden, 7-1-1924.

5. Adult female skeleton. Leiden Museum, reg. no. 1721. Java, from C. Blazer, Rotterdam, 28-12-1928.

6. Adult female skeleton. Leiden Museum, reg. no. 1715. Java, from C. Blazer, 5-12-1928.

7. Adult skull. Leiden Museum, reg. no. 4982. Toeloeng Agoeng, Java, from the collection of E. Dubois, 1941.

---

1) In a publication just received (Neue Pithecanthropus-Funde 1936-1938. Wet. Med. Dienst Mijnb. Ned. Ind., no. 28, 1940, p. 55/56) Von Koenigswald distinguishes three species of *Hystrix* in the fossil fauna of Java, one of which is believed to be identical with the recent Javan form. The second is stated to be smaller; it may be *Thecurus sumatrae* Lyon subsp. The third is only stated to be very much larger than the living Javan form, and very rare. Unfortunately Von Koenigswald gives neither figures nor measurements.

2) Pleistocene remains from Europe have been recorded under this name by Trouessart (1897, p. 616), Stromer von Reichenbach (1912, p. 171) and Zázvorka (1944). Such a range is rather wide for a species whose distribution is not influenced by man.

8. Adult skeleton. Leiden Museum, cat. a. Java.

9. Adult skull. Leiden Museum, cat. g. Java, from Van Raalten. Occiput damaged.

10. Adult skeleton. Leiden Museum, cat. b. Java.

11. Adult male skull. Leiden Museum, reg. no. 4983. Toeloeng Agoeng, Java, from the collection of E. Dubois, 1941.

Acanthion brachyurus longicaudum (Marsden)

1. Young female skull (M^2 erupting). Leiden Museum, reg. no. 1270. Padang, W. Sumatra. From the Rotterdam Zoological Garden, 12-11-1923.

2. Nearly adult male skull (M^3 erupted but unworn). Leiden Museum, reg. no. 1112. Padang, W. Sumatra. From the Rotterdam Zoological Garden, 15-11-1921 (imported 14-12-1920).

3. Adult skull. Leiden Museum, reg. no. 1128. Klein Soengei, Karang, Serdang, Sumatra. F. C. van Heurn don., 1-3-1922.

4. Adult skull. Leiden Museum, reg. no. 2543. Bangoeng Poerba, Deli, Sumatra. P. J. Nieuwdorp don., 6-10-1936.

5. Adult female skull. Leiden Museum, reg. no. 4981. Singkarah, W. Sumatra, from the collection of E. Dubois, 1941.

6. Adult female skeleton. Leiden Museum, cat. b. Deli, Sumatra, from the Rotterdam Zoological Garden, February 1896 (under the name *A. mülleri* Jentink).

7. Adult skull. Leiden Museum, listed as *A. javanicum* Cuvier, cat. h, by Jentink (1887, p. 232). Tandjoeng Morawa, Deli, Sumatra. B. Hagen don., 1882. The right half of the mandible is missing.

8. Adult skeleton. Leiden Museum, cat. a (as *A. mülleri* Jentink). Padang Besi, Sumatra. Collected by S. Müller. Skull figured by Jentink (1887, pl. VIII figs. 1-3).

Thecurus sumatrae Lyon

1. Nearly adult skull (M^3 erupted but unworn). Leiden Museum, catalogued by Jentink (1887, p. 232) as *Acanthion javanicum* Cuvier, cat. j. Tandjoeng Morawa, Deli, Sumatra. B. Hagen don., 1882.

2. Adult skeleton. Leiden Museum, as cat. d of *A. javanicum* Cuvier. Deli, Sumatra, from B. Hagen, 1885.

3. Adult skull. Leiden Museum, listed as *A. javanicum* Cuvier, cat. i. Tandjoeng Morawa, Deli, Sumatra. B. Hagen don., 1882.

Thecurus crassispinis (Günther) [1])

1. Adult skeleton. Leiden Museum (as *A. mülleri* Jentink). Tutong river, Brunei, N. Borneo. Collected by J. Waterstraat, purchased from H. Rolle, Berlin, January 1899.

2. Adult male skeleton. Leiden Museum, reg. no. 4104. From the Rotterdam Zoological Garden, 23-10-1939.

Trichys lipura Günther

1. Adult male skull. Leiden Museum (as *T. fasciculata* (Shaw)). Mt. Kalulong, N. Borneo. Presented by Ch. Hose. Posterior portion of calvarium missing.

2. Adult male skull. Leiden Museum (as *T. fasciculata*). Roema Manoeal, Southern foot of Mt. Kenepai, Borneo. Collected by Büttikofer, 30-12-1893. Nasals missing.

Trichys macrotis Miller

1. Adult female skeleton. Leiden Museum, reg. no. 1846. Sumatra. From the Rotterdam Zoological Garden, 3-6-1930.

Trichys fasciculata (Shaw)

1. Skeleton of young (M^2 not yet erupted). Leiden Museum, cat. a, as "*Atherura macrura* Linné". Malay Peninsula, received from Diard.

The finding of two skulls and a skeleton of *Thecurus sumatrae* Lyon under the name *Acanthion javanicum* Cuvier was quite unexpected. In the osteological catalogue of the Museum, Jentink (1887, p. 232) mentions them as belonging to young individuals (no doubt on account of their small size as compared to *A. brachyurus javanicum* Cuvier or *A. b. longicaudum* (Marsden)), though in all of them the M^3 is in use, or has at least erupted. The record of *A. javanicum* Cuvier from Tandjoeng Morawa, Deli, Sumatra, by Jentink (1889, p. 28) is based on these specimens. Another skull of Hagen's Deli collection listed as *A. javanicum* Cuvier by Jentink (1887, p.

1) It is remarkable that Lyon (1907, p. 581) did not recognize this species as belonging to his genus *Thecurus*. For the shortness of the nasals (comprised in the dorsal outline nearly 3½ times, see Lyon, l.c., p. 577, and Günther, 1876, p. 737 fig. 1) it belongs to *Thecurus, Atherurus* or *Trichys*. The last genus is excluded because of the broad jugal which has no lateral groove, and the absence of a well-marked fossa on the outside of the mandible beneath the condylo-coronoid notch (Günther, l.c., p. 738 fig. 2) excludes *Atherurus*. Leche (1921, p. 19) is well aware that *crassispinis* must be referred to *Thecurus*, if the latter is accepted as a separate genus.

232, cat. h) belongs to *A. b. longicaudum* (Marsden) (nearly all specimens of the latter subspecies in the Leiden Museum bear Temminck's MS. name *Hystrix mülleri,* see Marshall, in: Sclater, 1871, p. 235 footnote).

Acanthion brachyurus javanicum Cuvier and *A. b. longicaudum* (Marsden) differ mainly in size. Jentink (1879, p. 90) states that the skull of "*H. Mülleri*" is longer and narrower, and has longer nasals than that of *A. b. javanicum* Cuvier. Furthermore in the latter the upper tooth-series is stated to be longer than in *A. b. longicaudum* (Marsden), while the median posterior border of the palate is on a level with the anterior margin of M^3, whereas in the Sumatran form the molar series does not extend behind the median posterior border of the palate. The latter differences indeed hold for the skulls Jentink had at hand (*A. b. javanicum* Cuvier: nos. 8, 9 and 10; *A. b. longicaudum* (Marsden): no. 8), but the material afterwards received in the Leiden Museum shows these characters to be not constant. The measurements of the adult skulls examined by me are given in table I. It will be seen, that the skulls of *A. b. longicaudum* (Marsden) are longer (basilar length 109-114 mm) than those of *A. b. javanicum* Cuvier (92-99 mm); that the skull is often relatively narrower (relation of zygomatic breadth to basilar length 0.58-0.62 in the former, against 0.61-0.67 in the latter subspecies), and that in relation to their breadth the nasals often are longer in *A. b. longicaudum* (Marsden) (0.43-0.51) than in the Javan subspecies (0.49-0.57). Besides the skeletons, I have also examined the skins from Java and Sumatra, but beyond the difference in size of the adults, I found no characters to distinguish between them.

There is an *Acanthion* skeleton in the Leiden Museum (reg. no. 1269) received from the Rotterdam Zoological Garden 9-11-1923 (imported 21-4-1923), which is stated to come from Pangkalan Brandan, in N. E. Sumatra. The animal appears to be fully adult; the sutures of the skull are partly obliterated and the epiphyses of the bones are fused. It has suffered from rachitis, the bones (especially scapula, pelvis and tibia) are distorted, and the teeth are lost, except the incisors which are somewhat overgrown. The greatest length of the skull is 115 mm, the basilar length 93 mm, the zygomatic breadth 57 mm, and the height of the calvarium from the palate 38 mm. These measurements agree very well with those of *A. b. javanicum* Cuvier no. 10. The less deformed bones of the extremities are remarkably short, as appears from the subjoined measurements (mm):

	Leiden Museum	*A. brachyurus* *javanicum*		*longicaudum*	
	no. 1269	no. 8	no. 10	no. 8	no. 6
Humerus, lateral length	69	83	84	99	100
Femur, greatest length	85	98	101	117	112

TABLE I. Measurements of the skull (mm).

no. of specimen	*Hystrix leucura* Sykes		*Acanthion brachyurus javanicum* Cuvier						
	2	3	5	6	7	8	9	10	11
1. Greatest length	125	144	120	116	115	124	—	115	119
2. Upper length	113	132	116	112	112	120	—	113	114
3. Length of nasals	64	81	49	49	47	49	44	46	47
4. 3 : 2	0.57	0.61	0.42	0.44	0.42	0.41	—	0.41	0.41
5. Length of frontals	28	ca. 27	35	ca. 32	35	ca. 37	37	34	33
6. Basilar length [1])	ca. 106	ca. 120	98	94	96	99	—	92	97
7. Diastema length	33	38	30	30	31	32	31	30	30
8. Length P^4–M^3 (alveoli)	31	34	26	25	24	25	24	25	25
9. Zygomatic breadth	63	74	62	63	59	64	62	57	60
10. 9 : 6	0.60	0.62	0.63	0.67	0.61	0.65	—	0.62	0.62
11. Greatest breadth of nasals	39	51	28	25	23	26	23	24	23
12. 11 : 3	0.61	0.63	0.57	0.51	0.49	0.53	0.52	0.52	0.49
13. Least postorbital breadth	42	53	39	37	36	37	36	33	34
14. Height of calvarium (palate)	53	59	41	40	40	43	40	42	38
15. Length P_4–M_3 (alveoli)	33	36	27	26	25	27	25	26	26

no. of specimen	*A.b. longicaudum* (Marsden)						*Thecurus sumatrae* Lyon		*T. crassispinis* (Günther)		*Trichys lipura* Günther		*T. macrotis* Miller
	3	4	5	6	7	8	2	3	1	2	1	2	1
1. Greatest length	138	138	135	135	137	137	100	103	120	124	—	81	85
2. Upper length	135	134	132	130	135	136	97	101	116	119	—	—	85
3. Length of nasals	57	58	58	58	56	59	27	28	36	40	28	—	25
4. 3 : 2	0.42	0.43	0.44	0.45	0.41	0.43	0.28	0.28	0.31	0.34	—	—	0.29
5. Length of frontals	40	38	43	34	42	38	36	36	41	44	—	28	26
6. Basilar length [1])	112	113	111	109	114	113	81	ca. 84	99	102	—	67	68
7. Diastema length	36	34	38	34	37	38	23	26	33	34	27	23	22
8. Length P^4–M^3 (alveoli)	26	28	23	28	27	22	21	20	24	25	16	—	15
9. Zygomatic breadth	68	67	64	65	71	66	54	ca. 53	60	61	—	40	43
10. 9 : 6	0.61	0.59	0.58	0.60	0.62	0.58	0.67	0.63	0.61	0.60	—	0.60	0.63
11. Greatest breadth of nasals	29	29	25	26	27	26	16	ca. 16	18	18	13	—	11
12. 11 : 3	0.51	0.50	0.43	0.45	0.48	0.44	0.59	0.57	0.50	0.45	0.46	—	0.44
13. Least postorbital breadth	45	43	41	43	46	39	29	30	34	33	19	17	17
14. Height of calvarium (palate)	47	48	46	45	48	45	30	32	36	40	24	21	21
15. Length P_4–M_3 (alveoli)	28	30	26	29	29	24	23	21	26	26	16	15	15

I am not certain about the subspecific position of this diseased and undersized menagerie-specimen. If it belongs to the Javan subspecies, and if the locality-record is correct, it would be the first evidence of the presence of the Javan porcupine in Sumatra, since Jentink's statement as to the occurrence of *A. b. javanicum* Cuvier in Sumatra has been shown above to be based on wrongly identified specimens. But notwithstanding the more disproportionate dimensions the specimen also may belong to *A. b. longicaudum* (Marsden). As the specimen has no cheek teeth, it is left out of consideration for the present.

The teeth in the series of skulls of *A. b. javanicum* Cuvier and *A. b. longicaudum* (Marsden) show a great range of variation in the enamel pattern. The study of these patterns and of their change with the amount of wear does not reveal a single reliable character to distinguish between the Javan and the Sumatran form of *Acanthion*. The majority of the teeth of *A. b. longicaudum* (Marsden), however, presents greater dimensions than those of *A. b. javanicum* Cuvier.

The teeth of *Thecurus sumatrae* Lyon, which are of smaller size than those of the two above mentioned species, do not show structural differences either. A complete tooth-series, however, is distinguished by the relatively smaller size of the last molar, both in the upper and in the lower jaw.

The cheek teeth of the third Sumatran porcupine, *Trichys macrotis* Miller, are at once distinguished by their small size, relatively greater breath, and better developed roots. The incisors are much compressed laterally. I did not meet with teeth of the latter species in the cave collection from Sumatra.

The fossil and subfossil rami with teeth from Java and Sumatra to be described below are part of the Dubois Collection (on later pages registered as Coll. Dub.). They present different stages of wear. To facilitate the descriptions, the order in which the specimens are described is in accordance with their age. First some words about the dental nomenclature. It is possible, as done by Stirton (1935, p. 392/93) in the case of beavers, to apply the tritubercular system of nomenclature to the teeth of porcupines. Lower teeth present one external and three internal enamel inflections, but they are seldom shown all at the same time, as is the case in the tooth represented in fig. 1. With progressing wear the infoldings become isolated, so as to form enamel lakes, or fossettes, on the crown (fig. 2).

In the figures the inflections and lakes are indicated by the letters a-d, and the terminology is as follows:

letter in figure	enamel inflection	enamel lake
a	hypoflexid	hypofossettid
b	paraflexid	parafossettid
c	mesoflexid	mesofossettid
d	metaflexid	metafossettid.

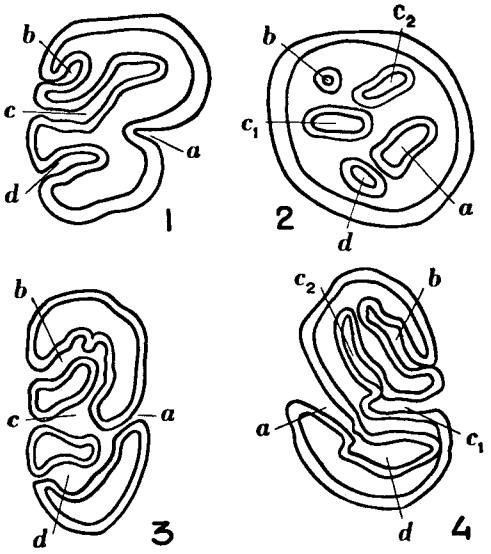

Fig. 1. *Hystrix leucura* Sykes, M_3 dext., India, Leiden Museum, cat. b. × 4.

Fig. 2. *Acanthion brachyurus* (L.), subsp., M_3 dext., Sumatra, Coll. Dub. no. 1122a. × 4.

Fig. 3. *Acanthion brachyurus* (L.) subsp., pd_4 dext., Sumatra, Coll. Dub. no. 943a. × 4.

Fig. 4. *Acanthion brachyurus longicaudum* (Marsden), pd_4 sin., Padang, W. Sumatra, Leiden Museum, reg. no. 1270. × 4.

Acanthion brachyurus (L.) subsp.

The enamel pattern of the pd_4 in a fragment of the right ramus from a Sumatran cave (Coll. Dub. no. 943a) is represented in fig. 3. The tooth is in an early stage of wear, and the four principal inflections are shown as valleys, which divide the crown surface into four enamel islands. There is some variation in the order in which these valleys become closed. In *Acanthion b. longicaudum* no. 1 (fig. 4) the metaflexid (d) and the paraflexid (b) are isolated inwards. The mesoflexid (c) is just divided into two parts, and has lost the contact with the other flexids. In fig. 5, which gives the pattern of the pd_4 in another portion of a subfossil right ramus from Sumatra (Coll. Dub. no. 944a) the metaflexid (d) is constricted off from the hypoflexid (a), and also the subdivision of the mesoflexid (c) and the separation of the paraflexid (b) and the metaflexid (d) from the inner enamel border of the tooth is more complete than in the foregoing specimen. However, the para- and mesofossettid are still confluent anteriorly, and the hypoflexid has only just lost the contact with the mesoflexid.

Coll. Dub. no. 10047a. Portion of left ramus with pd_4, M_1 (slightly worn), and M_2 (erupting), from Goea Djimbe, near Redjotangan, Res. Kediri, E. Java. The enamel pattern of the pd_4 is represented in fig. 6. The crown surface consists of two parts. Both the metaflexid (d) and the paraflexid

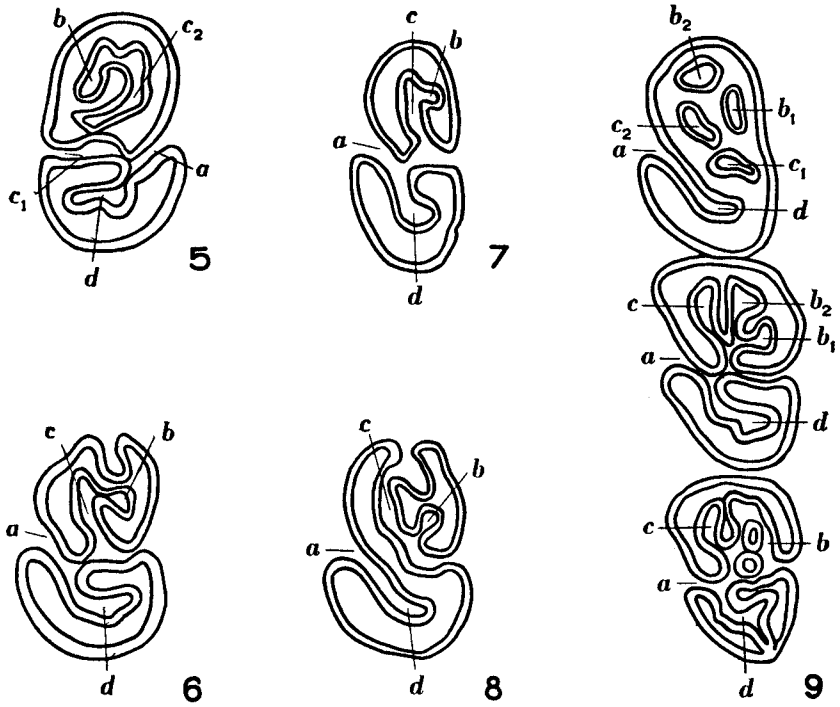

Fig. 5. *Acanthion brachyurus* (L.) subsp., pd_4 dext., Sumatra, Coll. Dub. no. 994a. × 4.
Fig. 6. *Acanthion brachyurus* (L.) subsp., pd_4 sin., Goea Djimbe near Redjotangan, Res. Kediri, E. Java, Coll. Dub. no. 10047b. × 4.
Fig. 7. *Acanthion brachyurus javanicum* Cuvier, pd_4 sin., Java, Leiden Museum, cat. f. × 4.
Fig. 8. *Acanthion brachyurus javanicum* Cuvier, pd_4 sin., Leiden Museum, cat. b. × 4.
Fig. 9. *Acanthion brachyurus* (L.) subsp., pd_4-M_2 sin., Goea Djimbe near Redjotangan, Res. Kediri, E. Java, Coll. Dub. no. 10047b. × 4.

(b) are closed lingually; the former is confluent with the hypoflexid (a), whereas the latter is just isolated from the mesoflexid (c). The pattern differs not essentially from that of the corresponding tooth in *Acanthion b. javanicum* no. 1 (fig. 7), except that in the subfossil specimen there is an accessory inflection which opens to the anterior side of the crown. But this variation is of no importance, since it is also shown in *A. b. javanicum*

no. 2 (fig. 8). The pattern of the latter tooth differs from that of fig. 6 in the accessory inflection being united with the mesoflexid (c), and in the complete isolation of the latter from the hypoflexid. In this respect the subfossil tooth is intermediate between the two recent teeth.

Coll. Dub. no. 10047b (Goea Djimbe, near Redjotangan, Java). Left ramus with pd_4-M_2 (fig. 9). M_3 has not yet erupted. The pd_4 has both the paraflexid and the mesoflexid isolated as two fossettids (b_1, b_2, c_1, and c_2). In the M_1 the apex of the mesoflexid (c) is just isolated, the paraflexid (b) is double and opens into the mesoflexid. The M_2 presents an earlier stage of wear than the M_1; the two central enamel islands are not yet united with the inner enamel wall, consequently the paraflexid (b) is still undivided.

The comparison of the teeth of *Acanthion b. javanicum* no. 3 (fig. 10) with those of the present subfossil specimen shows differences which are mainly due to the more worn condition of the former. In the pd_4 we find a hypofossettid (a) and a metafossettid (d) and a single elongated mesofossettid (c). The parafossettids are smaller than in the corresponding subfossil tooth. The M_1 has the mesoflexid (c) separated from the hypoflexid, and shows two parafossettids. The stage of wear of the M_2 is intermediate between those of M_1 and M_2 in fig. 9, the anterior of the two enamel islands is connected with the inner enamel wall.

In *Acanthion b. javanicum* the two parafossettids may be confluent with the labial portion of the mesofossettid, which is disconnected from the main part of the mesoflexid so as to form an h-shaped enamel lake (fig. 11, M_2 and M_3). The M_1 in this series shows the common pattern, the four infoldings are represented by fossettids, the mesofossettid (c) is double. In the P_4 the parafossettid is also double, the hypoflexid is continuous with the metaflexid, which is closed inwards, just as in the posterior molars.

Coll. Dub. no. 1488a (Bangle, fig. 12). Portion of a fossil right ramus with P_4-M_2. The specimen has suffered from crush. The anterior portion of the ramus is distorted, and the incisor, which is partially preserved, is fractured. The three cheek teeth, which, as appears from the presence of pressure marks, were pressed together in the living animal, are separated by intervals of about 2 mm. The wearing surface of M_1 is placed below, that of M_2 above the level of that of P_4. The ramus has broken off obliquely behind M_2. On the outer side, a mental foramen is situated slightly in front of, and below the P_4. The latter tooth is damaged anteriorly. The hypoflexid (a) is still open, the long transverse lake at its apex is the metafossettid (d). The mesoflexid (c) is isolated into two fossettids, of which the lingual is still connected with the enamel border of the crown. The small enamel lake which borders at the broken anterior edge of the tooth, repre-

sents the parafossettid (b). In the M_1 the paraflexid is represented by two fossettids (b_1, b_2), the posterior of which is merely an enamel remnant.

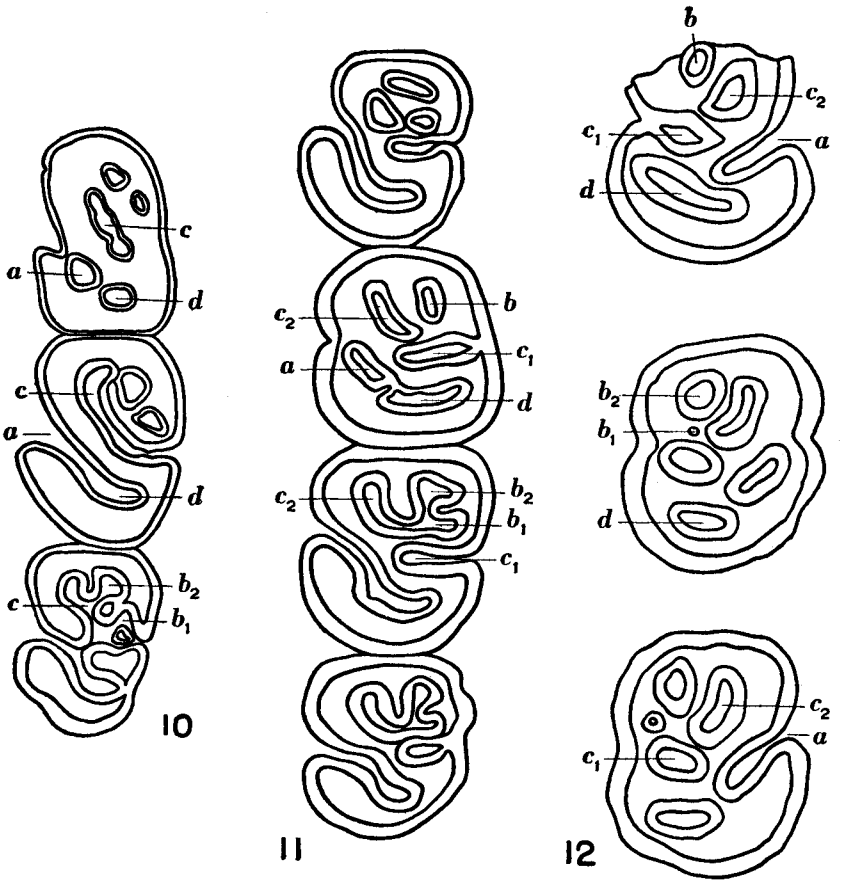

Fig. 10. *Acanthion brachyurus javanicum* Cuvier, pd_4-M_2 sin., Java, Leiden Museum, cat. e. × 4.

Fig. 11. *Acanthion brachyurus javanicum* Cuvier, P_4-M_3 sin., Java, Leiden Museum, cat. b. × 4.

Fig. 12. *Acanthion brachyurus* (L.) subsp., P_4-M_2 dext., Bangle, Java, Coll. Dub. no. 1488a. × 4.

The M_2 is less worn than the M_1, the hypoflexid (a) is open, and the posterior parafossettid is larger than that in M_1.

Two separate fossil lower molars originate from Soember Kepoeh, near Bangle. They are of the right side, and about in the same stage of wear as the M_1 in the Bangle ramus. One (Coll. Dub. no. 1488b, fig. 13) has a double posterior parafossettid (b_1, b_2); in the other (Coll. Dub. no. 1488c,

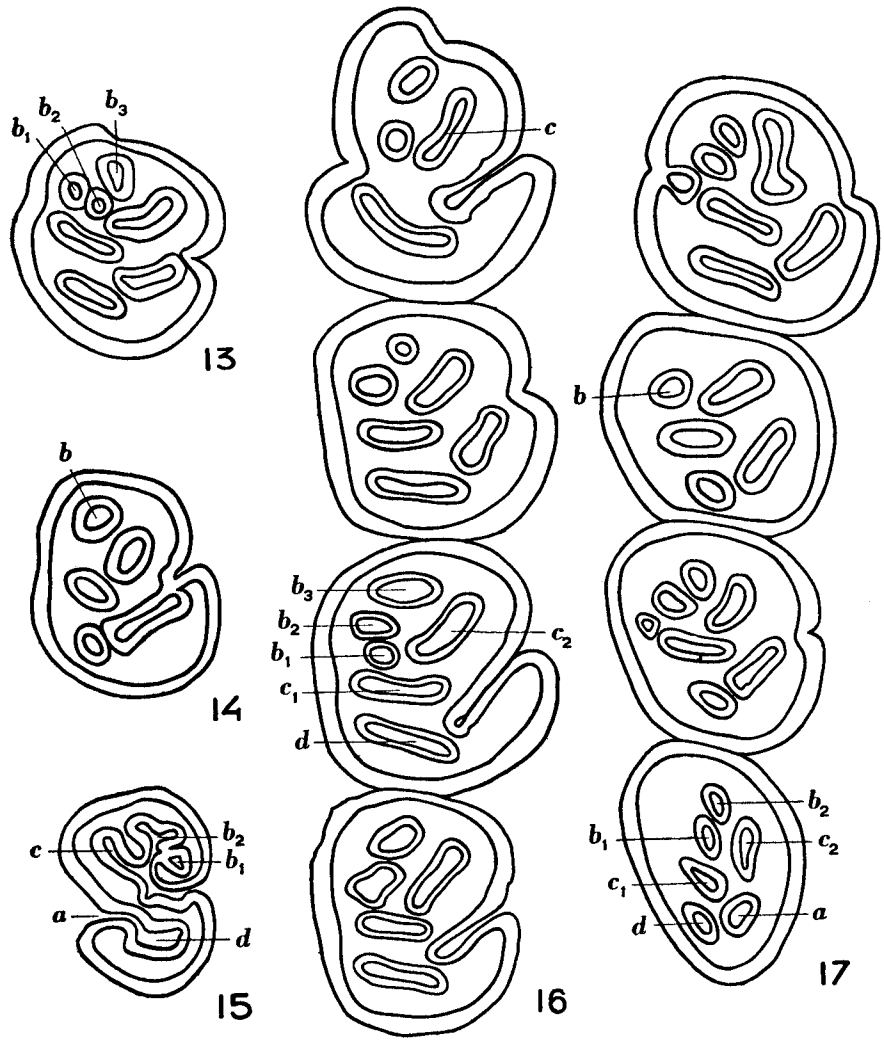

Fig. 13. *Acanthion brachyurus* (L.) subsp., M1 or M2 dext., Soember Kepoeh near Bangle, Java, Coll. Dub. no. 1488b. × 4.

Fig. 14. *Acanthion brachyurus* (L.) subsp., M1 or M2 dext., Soember Kepoeh near Bangle, Java, Coll. Dub. no. 1488c. × 4.

Fig. 15. *Acanthion brachyurus* (L.) subsp., M3 sin., Pati Ajam, Japara, Java, Coll. Dub. no. 1661a. × 4.

Fig. 16. *Acanthion brachyurus* (L.) subsp., P4-M3 dext., Sumatra, Coll. Dub. no. 829f. × 4.

Fig. 17. *Acanthion brachyurus* (L.) subsp., P4-M3 dext., Sumatra, Coll. Dub. no. 1122b × 4.

fig. 14), however, the parafossettid is single. The M_1 of the fossil ramus, with its tiny posterior parafossettid, thus presents a structure intermediate between the two Soember Kepoeh specimens.

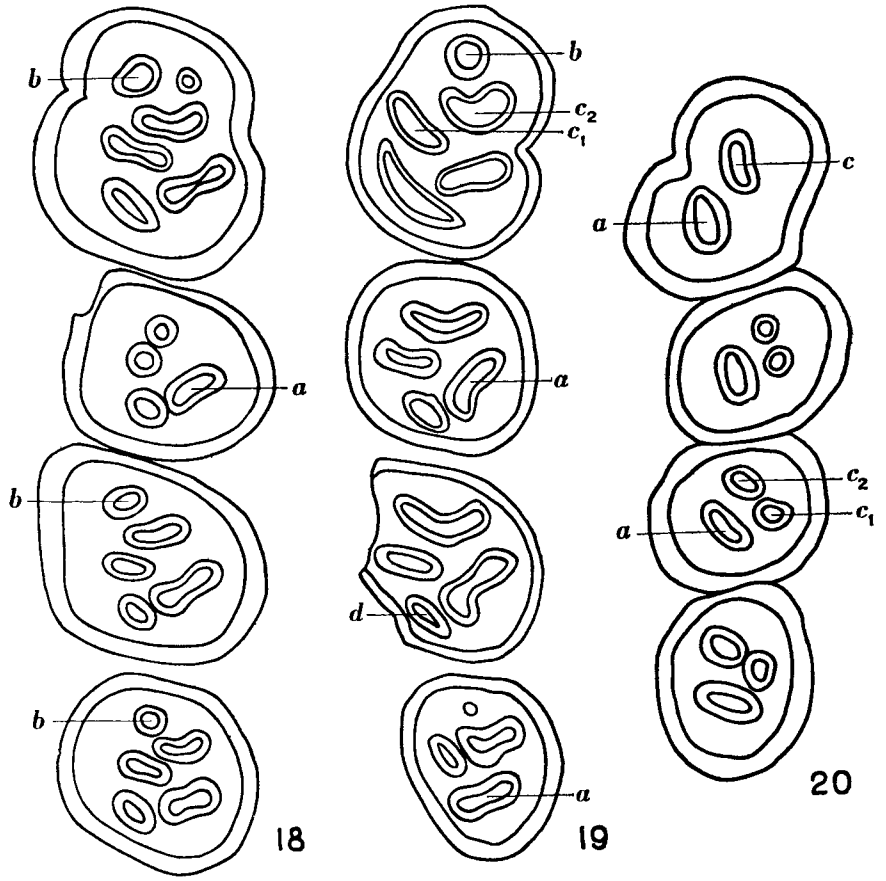

Fig. 18. *Acanthion brachyurus* (L.) subsp., P_4-M_3 dext., Lida Ajer cave, Sumatra, Coll. Dub. no. 699a. × 4.
Fig. 19. *Acanthion brachyurus* (L.) subsp., P_4-M_3 dext., Goea Djimbe near Redjotangan, Res. Kediri, E. Java, Coll. Dub. no. 10047c. × 4.
Fig. 20. *Acanthion brachyurus longicaudum* (Marsden), P_4-M_3 sin., Padang Besi, Sumatra, Leiden Museum, cat. a. × 4.

An isolated left M_3 from Pati Ajam, Java (Coll. Dub. no. 1661a, fig. 15) differs hardly in structure from the M_1 of fig. 9.

More advanced stages of wear of complete lower tooth series are shown in figs. 16-20. It seems not necessary to discuss them at length.

The measurements of the teeth, taken at the wearing surface, are given in table II; in table III the range of variation is represented.

TABLE II. Measurements of the lower teeth (mm).

	Coll. Dub. no.		Coll. Dub. no. 10047			*Acanthion brachyurus javanicum* Cuvier										
	1488a	1661a	a	b	c	1	2	3	4	5	6	7	8	9	10	11
pd_4 length	—	—	7.0	6.9	—	7.2	6.5	6.4	6.7	—	—	—	—	—	—	—
breadth	—	—	4.9	4.4	—	3.8	4.6	4.7	4.8	—	—	—	—	—	—	—
P_4 length	—	—	—	—	8.1	—	—	—	—	7.0	6.5	6.5	5.6	5.7	5.9	6.3
breadth	6.3	—	—	—	5.9	—	—	—	—	5.8	5.6	5.0	4.9	4.8	5.1	5.5
M_1 length	7.3	—	7.2	6.6	6.0	—	6.7	6.3	6.8	6.7	6.2	6.1	6.5	6.0	6.0	6.2
breadth	6.0	—	4.8	5.2	5.9	—	4.8	5.0	5.3	5.7	5.4	5.7	5.6	5.3	5.8	5.8
M_2 length	7.4	—	—	5.5	7.0	—	—	5.6	6.7	6.6	6.0	5.8	6.6	6.1	5.9	6.1
breadth	6.2	—	—	4.4	5.8	—	—	4.6	4.8	5.3	5.1	5.0	5.7	5.1	5.7	5.8
M_3 length	—	6.7	—	—	6.1	—	—	—	—	5.5	4.7	5.3	5.2	5.3	5.6	5.7
breadth	—	5.0	—	—	4.8	—	—	—	—	4.7	4.8	4.4	4.4	4.5	4.8	4.8

	A.b. longicaudum (Marsden)								Coll. Dub. no.						
	1	2	3	4	5	6	7	8	943a	944a	7001a	829f	1122a	1122b	699a
pd_4 length	7.3	5.6	—	—	—	—	—	—	7.2	7.3	—	—	—	—	—
breadth	5.1	4.0	—	—	—	—	—	—	4.3	4.4	—	—	—	—	—
P_4 length	—	—	6.8	7.6	6.0	8.5	8.4	7.0	—	—	—	8.8	8.8	8.9	8.5
breadth	—	—	5.2	6.4	4.7	6.9	6.8	5.2	—	—	—	7.4	7.1	7.5	7.0
M_1 length	7.5	6.3	7.6	7.0	6.3	6.4	6.7	5.4	—	7.4	7.5	7.2	7.0	6.7	6.0
breadth	5.5	5.0	5.8	6.6	5.8	6.5	7.2	5.3	—	—	6.2	6.9	6.8	7.2	7.2
M_2 length	—	—	7.5	—	6.4	6.7	7.3	5.0	—	—	7.4	7.8	7.2	7.0	7.0
breadth	—	—	5.8	—	5.5	6.6	7.2	5.4	—	—	6.2	7.3	7.5	6.6	7.3
M_3 length	—	—	6.6	7.1	5.6	6.4	6.9	5.9	—	—	6.8	7.6	6.4	8.1	6.7
breadth	—	—	5.2	5.7	4.6	5.5	5.6	4.8	—	—	5.2	6.4	6.2	6.0	5.9

TABLE III. Range of variation of measurements of lower teeth (mm).

	recent Java	subfossil Java	fossil Java	recent Sumatra	subfossil Sumatra
pd_4 length	6.4–7.2	6.9–7.0	—	5.6–7.3	7.2–7.3
breadth	3.8–4.8	4.4–4.9	—	4.0–5.1	4.3–4.4
P_4 length	5.6–7.0	8.1	—	6.0–8.5	8.5–8.9
breadth	4.8–5.8	5.9	6.3	4.7–6.9	7.0–7.5
M_1 length	6.0–6.8	6.0–7.2	7.3	5.4–7.6	6.0–7.5
breadth	4.8–5.8	4.8–5.9	6.0	5.0–7.2	6.2–7.2
M_2 length	5.6–6.7	5.5–7.0	7.4	5.0–7.5	7.0–7.8
breadth	4.6–5.8	4.4–5.8	6.2	5.4–7.2	6.2–7.5
M_3 length	4.7–5.7	6.1	6.7	5.6–7.1	6.4–8.1
breadth	4.4–4.8	4.8	5.0	4.6–5.7	5.2–6.4

The maximum values found in the subfossil and fossil Javan material are seen to be intermediate between those of *Acanthion brachyurus javanicum* Cuvier and *A. b. longicaudum* (Marsden), whereas the measurements of the Sumatran cave teeth lie to the higher side of, or above, the range of variation of the recent subspecies of that island.

It is remarkable that the Pleistocene teeth from Java fall within the limits of the recent Sumatran race, and I have asked myself whether I should be justified to refer the fossil teeth to *Acanthion brachyurus longicaudum* (Marsden), and, in the same way, the subfossil Sumatran cave teeth to *A. b. brachyurus* (L.).

The case of the porcupine offers an interesting analogon to those of other mammals in the Dubois collection which are likewise represented by one and the same species in the Pleistocene, prehistoric and recent fauna throughout. It can hardly be ascribed to mere coincidence that the series of teeth from the prehistoric Goea Djimbe cave of Java averages smaller than the likewise prehistoric teeth from Sumatra. This is just what we could expect on the evidence of the Pleistocene teeth from Java which are of the same size as those of the recent Sumatran form. The latter has, like the race of Java, undergone a diminution in size in the course of time, and the process is more advanced in Java than it is in Sumatra.

I see the present case now as an example of a species dating from the Pleistocene with at least two subspecies (a Javan and a Sumatran, but most probably a third on the continent) which has come down to the present by means of each of the subspecies having gradually changed its characters into those of one of the subspecies existing to-day. Unfortunately we know nothing of really Pleistocene porcupines of Sumatra or of Pleistocene or

prehistoric ancestors of the recent continental subspecies which would enable us to substantiate this case completely.

I believe that, though the Pleistocene teeth from Java are indistinguishable from those of the recent Sumatran subspecies, we are not justified to give them the same subspecific name. The Pleistocene Javan form has never been named by Dubois or by any other author, and for the present it seems best to leave the form unnamed until we shall have more material which will make it possible to separate it from *A. b. longicaudum* (Marsden).

Acanthion brachyurus (L.) is a species likely to present us a most beautiful example of gradual transformation in the time dimension completely analogous to what neozoologists have long been able to recognize in the recent fauna, and which they have called clines (Huxley, 1939). Much work remains to be done along the lines which I have only been able to indicate vaguely in the present paper but which, I hope, will give rise to further research.

LITERATURE

ANONYMUS, 1889-90. Palaeontologische Onderzoekingen ter Westkust van Sumatra. Verslag Mijnwezen 2e kwartaal 1889 (1889), pp. 8-9; Id. 3e kwartaal 1889 (1889), p. 10; Id. 4e kwartaal 1889 (1890), pp. 10-11.

——, 1891. Palaeontologische Onderzoekingen op Java. Verslag Mijnwezen 1e kwartaal 1891, pp. 12-13.

——, 1893. Palaeontologische Onderzoekingen op Java. Verslag Mijnwezen 4e kwartaal 1892, pp. 11-12.

DUBOIS, E., 1907. Eenige van Nederlandschen kant 'verkregen uitkomsten met betrekking tot de kennis der Kendeng-Fauna (Fauna van Trinil). Tijdschr. Kon. Ned. Aardr. Gen., ser. 2, vol. 24, pp. 449-458.

——, 1908. Das Geologische Alter der Kendeng- oder Trinil-Fauna. Tijdschr. Kon. Ned. Aardr. Gen., ser. 2, vol. 25, pp. 1235-1270, pl. 39.

GÜNTHER, A., 1876. Report on some of the Additions to the Collection of Mammalia in the British Museum. Proc. Zool. Soc. London, 1876, pp. 735-751, pls. LXIX-LXXIV, 9 figs.

HUXLEY, J. S., 1939. Clines: an auxiliary method in taxonomy. Bijdragen tot de Dierkunde, livr. 27, pp. 491-520, 9 figs.

JENTINK, F. A., 1879. On the Sumatra Porcupine, Hystrix mülleri, Temminck MS. Notes Leyden Museum, vol. 1, pp. 87-91.

——, 1887. Catalogue Ostéologique des Mammifères. Muséum d'Histoire Naturelle des Pays-Bas, vol. 9, 360 pp., 12 pls.

——, 1889. On a collection of Mammals from East-Sumatra. Notes Leyden Museum, vol. 11, pp. 17-30.

KOENIGSWALD, G. H. R. VON, 1934. Zur Stratigraphie des javanischen Pleistocän. De Ing. in Ned. Indië, vol. 1, sect. IV, pp. 185-201, pls. III-IV.

LECHE, W., 1921. Morphologisch-geographische Formenreihen bei den Säugetieren. Lunds Univ. Årsskr., N.F., Avd. 2, vol. 16, no. 10, 76 pp., 11 figs.

LYON, M. W., 1907. Notes on the Porcupines of the Malay Peninsula and Archipelago. Proc. U.S. Nat. Mus., vol. 32, pp. 575-594, pls. LIV-LVII.

SCLATER, P. L., 1871. Notes on rare or little-known Animals now or lately living

in the Society's Gardens. Proc. Zool. Soc. London, 1871, pp. 221-240, pls. XIV-XVII, 6 figs.

STIRTON, R. A., 1935. A review of the Tertiary beavers. Univ. Calif. Publ., Bull. Dept. Geol., vol. 23, no. 13, pp. 391-458, 2 charts, 142 figs., 1 map.

STREMME, H., 1911. Die Säugetiere mit Ausnahme der Proboscidier, in: Selenka-Blanckenhorn, Die Pithecanthropus-Schichten auf Java, Geologische und Paläontologische Ergebnisse der Trinil-Expedition (1907 und 1908). Leipzig, pp. 82-150, pls. XVI-XX, 10 figs.

STROMER VON REICHENBACH, E., 1912. Lehrbuch der Paläozoologie. II. Teil. Wirbeltiere. Berlin, VIII + 325 pp., 234 figs.

TROUESSART, E.-L., 1897. Catalogus Mammalium tam viventium quam fossilium. Nov. ed., fasc. III, Rodentia II. Berlin, pp. 453-664.

ZAZVORKA, V., 1944. Nález spodní čelisti plistocénního dikobraza Hystrix leucura Sykes v Moravském krasu. Věstník Královskē Ceské Společnosti Nauk (separate copy), 8 pp., 2 figs.