ON FOSSIL REMAINS OF A HYAENID FROM JAVA

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(with plate XIII)

Fossil remains of a hyaenid were discovered at Kedoeng Broeboes, Kebon Doeren and Tegoean by Prof. Eug. Dubois during his palaeontological searches in Java. These remains have been mentioned in literature as *Hyaena felina* (Dubois, 1891, pp. 94, 95; Anonymus, 1891, p. 14), but later they were described as belonging to a distinct species, *Hyaena bathygnatha* (Dubois, 1908, p. 1265). Recently von Koenigswald (1935, p. 68, figs. 3, 4) described two lower fourth premolars of a hyaenid from Sangiran, Java, which he considered to be identical with *Hyaena sinensis* Owen; provisionally von Koenigswald referred *H. bathygnatha* to the synonymy of *H. sinensis*. As the original description of *Hyaena bathygnatha* does not contain much positive information on the types (neither measurements nor figures were given), they are redescribed in the following notes, and as far as this is possible *Hyaena bathygnatha* is compared with related species.

I am greatly indebted to Prof. Dr. Eug. Dubois for entrusting me with this valuable material. My special thanks are also due to Dr. Birgir Bohlin, Universitets Palaeontoligska Institution, Upsala, for the loan of specimens of *Crocuta sinensis* (Owen).

The following specimens are preserved in the Collection Dubois.

Reg.no. 2573, mandible, Kebon Doeren (pl. XIII figs. 4, 9, 13). The left ramus has the processus coronoideus, the condylus, and the tip of the processus angularis broken off; the symphysis is damaged, the incisivi are lost; of the canine only the root is preserved; P_1 absent; P_2 and P_3 present, much worn; P_4 much worn, damaged anteriorly; M_1 much worn, damaged both anteriorly and posteriorly. Of the right ramus only the anterior part is preserved with the roots of I_1 and I_2, and with I_3, the roots of the canine and of P_2; behind P_2 the ramus is broken off.

The cheekteeth are placed in a curved line (pl. XIII fig. 9). The single foramen mentale opens into an oval depression, which is situated below the posterior root of P_2 and the anterior root of P_3. The symphysis projects downward below P_2. Except for this projection of the symphysis the lower border of the mandible is rather straight to below the posterior root of M_1, where it curves gradually upward to below the anterior part of the fossa masseterica; here the lower border of the mandible makes a short, but well marked curve upward, and from there it runs nearly straight to the processus angularis. The shape of the fossa masseterica is slightly different from that of the specimen of *Crocuta sinensis*, which I examined for comparison. Its anterior border, which runs obliquely from antero-superior to infero-posterior, is very short; it meets the inferior border of the fossa at a distinct angle, while in *Crocuta sinensis* the anterior border passes with a more gradual curve into the inferior border. The lower border of the mandible is somewhat obliquely flattened on the inner side.

The fragment of the right ramus (pl. XIII fig. 4) had been pasted to the left ramus; as they incidentally were loosened again they are figured separately. Obviously a small part of the symphysial surface of both fragments is lacking, and, therefore, they do not fit exactly. Such as they were pasted together by Dubois the anterior border of the right canine was situated slightly in front of that of the left canine. If the roots of the canines are placed in a line the infero-posterior border of the symphysial part of the right ramus projects slightly beyond that of the left ramus. Moreover the width of the symphysial part of the right ramus (between C and P_2) is slightly larger than that of the left ramus. Nevertheless the fragments are so strikingly similar in state of preservation, and correspond so well with each other that there is no reason to doubt that these fragments did belong to one individual.

As the teeth are much worn they do not offer important clues as to the specific identity of the javan fossils. Some of their characters will be described below together with those of the other teeth.

Reg. no. 2575, fragment of a left mandible (pl. XIII figs. 1, 2), Kedoeng Broeboes. P_1 absent; P_2, P_3, P_4 and roots of M_1 are present. The teeth are much less worn than in the jaw described above.

Reg. no. 2574, right P_3, P_4 and fragment of right M_1, Kebon Doeren. The P_3 (pl. XIII figs. 6, 14) and P_4 (pl. XIII figs. 3, 5, 8) are so conspicuously similar in state of preservation, while different from the other specimens from the same locality, that I believe that they belong to one specimen. Probably the M_1 (pl. XIII fig. 15) did belong to this individual too.

Reg. no. 11238, left P_4 (pl. XIII figs. 7, 11) and fragment of a right P^4, Tegoean.

Reg. no. 11239, fragment of a premolar, loc.?

The measurements of the premolars are given in table I. The teeth are not so massive as those of *Crocuta sinensis*, but in general appearance they are very similar. The posterior cingulum of P_4 appears to be slightly better developed in the javan fossil than in the specimens of *Crocuta sinensis*. The javan teeth are not all identical in structure, but some differences were found which may be accounted for by individual variation.

TABLE I
(measurements in mm)

	Reg. no. 2573		Reg. no.	Reg. no.	Reg. no
	left	right	2575	2574	11238
C—M_1 (alv.)	126.0	—	—	—	—
length of I_3	—	8.7	—	—	—
breadth of I_3	—	7.9	—	—	—
greatest transverse diameter of C	24.0	24.0	—	—	—
diastema	15.2	15.3	—	—	—
length of P_2	17.3+	—	19.2	—	—
breadth of P_2	13.5	—	13.4	—	—
length of P_3	23.0	—	22.9+	24.1	—
breadth of P_3	15.5	—	16.3	17.3	—
length of P_4	24.2	—	27.5	25.7	23.7
breadth of P_4	15.5	—	16.8	16.5	14.8
breadth of M_1	13.5	—	—	14.5	—
depth of mandible in front of P_2	57.4	—	—	—	—
id. below P_3	52.4	—	—	—	—
id. below P_4	52.4	—	—	—	—
id. below M_1	58.0	—	—	—	—
P^4, length of posterior lobe	—	—	—	—	13.8
P^4, length of central lobe	—	—	—	—	12.1+

Incisors. The right I_3 is present in no. 2573. It is placed close to the canine, and is damaged posteriorly.

Canines. Only the roots are preserved.

Premolars.

P_1. Absent both in no. 2573 and 2575.

P_2. In no. 2575 this tooth is well preserved; a ridge runs downward over

the anterior surface of the central cusp to the antero-interior border, where it joins a swelling of the anterior cingulum. A very faintly marked posterior cusp (hardly more than a ridge) is present. In no. 2573 P_2 appears to be somewhat narrower anteriorly than the corresponding tooth of no. 2575, but as in no. 2573 the anterior border of the tooth is damaged this cannot b made out with certainty.

P_3. A ridge runs downward over the anterior surface of the central cusp to the antero-interior side of the tooth, where it joins a swelling of the anterior cingulum; except for this swelling no trace of a cusp can be found. The posterior cusp is small in no. 2574; it is broken off in no. 2575, and it is completely worn off in no. 2573. At the level of the central cusp these premolars show a constriction in nos. 2573 and 2575. In no. 2574 the outline is convex on the lingual side instead of concave as in the other specimens; in this tooth the enamel appears to reach farther downward anteriorly than in the other specimens.

P_4. Buccal view. The lower border of the crown reaches downward on the roots to a varying extent; this border shows a notch above the space between the roots. This notch differs in shape in the four premolars examined. In the fourth premolars of the mandibles nos. 2573, 2575 the notch is shallow and opens widely downward; in no. 2574 it is somewhat more distinctly marked, but it also opens widely downward; in no. 11238 this notch is slightly narrower, and in relation to its width deeper. In nos. 2573, 2575 the lower border of the crown curves downward on the posterior root, turning upward near the centre of the root, and from there it runs obliquely upward to the posterior side of the tooth. In no. 2574 the crown reaches somewhat farther downward on the posterior root, the upward curve is more strongly marked, and the lower border runs much more steeply upward to the posterior side of the tooth. In no. 11238 the upward curve is also rather well marked, but the lower border of the crown does not run gradually upwards to the posterior side of the tooth, but this part of the border is divided into a steeper, anterior section and a more faintly oblique, posterior section.

Lingual view. The lower border of the crown shows a notch above the space between the roots; this notch is extremely shallow in the specimens nos. 2573, 2575; it is more clearly marked in the P_4 from Tegoean (no. 11238), and it is very distinctly marked in no. 2574. In the latter tooth the enamel reaches farther downward on the roots; the lower border of the crown makes a well marked downward curve on the posterior root, and posteriorly it runs steeply upwards to the posterior side of the tooth. In the other specimens the downward curve is only faintly marked, and the border

of the crown runs upward to the posterior side of the tooth in a faintly oblique direction.

Anterior view. The enamel reaches farther downward on the root in no. 2574 than in the other specimens.

Upper (occlusial) view. The anterior cusp is well developed in nos. 2573, 2575, 2574, but is very weakly developed in no. 11238. In all specimens the posterior cusp is well developed. In no. 2574 the posterior cusp is connected with the posterior cingulum by two short ridges, which enclose a concavity; in the other specimens only one short ridge connects the posterior cusp and cingulum. The posterior cingulum is well marked. The anterior root shows a groove on its posterior surface, the posterior root one on the anterior surface.

The lower fourth premolars described by von Koenigswald (1935, p. 68, figs. 3, 4) resemble those examined by me, especially the loose P_4 from Kebon Doeren. From the Tegoean P_4 they differ in the larger anterior cusp; the tooth figured by von Koenigswald (l.c., fig. 3) is more concave at the lingual side than the teeth examined by me. The characters used by von Koenigswald to prove that the teeth he described must be referred to *Crocuta sinensis* (Owen), do not appear to be absolutely convincing.

Molars.

M_1. Nothing definite can be said of this tooth. In no. 2573 the posterior blade is broken, while the anterior blade is damaged on the inner side. Judging by what is preserved the anterior blade may have been slightly larger than the posterior one. In no. 2574 only the anterior root with part of the crown is preserved; the antero-exterior cingulum is well developed.

M_2. Absent; though the jaws are damaged behind M_1 no trace of an alveolus for a second molar was found.

The formula for the lower dentition, therefore, is I 3 C 1 P 3 M 1. By this formula the javan form is distinguished from the hyaenid genera [1]) *Ictitherium* Wagner (I 3 C 1 P 4 M 2), *Hyaenictis* Gaudry (I 3 C 1 P 3 or 4 M 2), *Lycyaena* Hensel (I 3 C 1 P 3 or 4 M 1 (2), anterior premolars in a straight line; lower premolars with well marked anterior and posterior cusps) and *Thalassictis* Gervais (M 2). The only genera which need be considered are, therefore, *Crocuta* Kaup (I 3 C 1 P 3 or 4 M 1) and *Hyaena* Briss. (I 3 C 1 P 3 M 1). The available specimens do not show any decisive character on which the species could be assigned to the one or the other of these genera. Its greatest resemblances are with the species which are placed by other authors (e.g., Pilgrim, 1932) in the genus *Crocuta* Kaup; it, there-

1) *Chasmaporthetes* Hay (1921, p. 636) from the pleistocene of N. America is too incompletely known to assign it with any certainty to the Hyaenidae.

fore, appears safest to refer the javan form provisionally to this genus. Another question is, whether the javan form represents a distinct species or that it belongs to one of the species known from the Asiatic continent, Europe and Africa. About nineteen species of the genus *Crocuta* are recognized at present; eighteen of these are wholly extinct. Besides seven recent skulls of *Crocuta crocuta* (Erxl.) sp. I examined two lower jaws and a skull of *Crocuta sinensis* (Owen). For the other species I had to rely on the descriptions and figures published by other authors. The generic position of some of these species is as yet uncertain. Pilgrim (1931, 1932) incorporates those known at that time in the genus *Crocuta* Kaup, while Pei (1934) prefers to include them all in the genus *Hyaena* Briss. s.l. For the present I have followed Pilgrim as I believe that there is sufficient reason to maintain *Crocuta* as a distinct genus, and that these species agree better with this genus than with *Hyaena*. It is not improbable, however, that the genus *Crocuta* will have to be divided in two genera or subgenera (cf. Pilgrim, 1931, pp. 109, 115; Pei, 1934, p. 90). In the existing descriptions of fossil Hyaenidae great stress is laid on the importance of the upper and lower carnassials (P_4 and M_1) for their classification. In the collection from Java these teeth are represented by fragments only, so that a satisfactory comparison with other species is almost impossible. Still I believed it to be worth while to search for other characters which show differences between the javan fossil and the other species. Should a more extensive material become available it is not improbable that some or all of these differences may prove to have the value of individual variations only, but for the present they show that differences, though often very slight ones, exist between the javan hyaenid and the other members of the genus *Crocuta*.

Dubois (1908, p. 1265) compared his *Hyaena bathygnatha* to *Hyaena felina* Bose and to *Hyaena brevirostris* Aymard; he did not state on which description of *Hyaena felina* he did rely, but probably he used Lydekker's (1884) description and figures. As Pilgrim (1932) has shown the *Hyaena felina* of Lydekker in part is *Crocuta sivalensis* (v. Meyer), in part it is *Crocuta felina* (Bose).

In the following I have enumerated all species of the genus *Crocuta* which, as far as our present knowledge goes, may be recognized as distinct species. For each I have cited the more important literature, especially those papers in which lower jaws are described or figured. Moreover I have indicated for the extinct species the horizon from which they have been recorded, such as it is given by the different authors who dealt with these species. I have not tried to indicate any correspondance in age that may exist between the strata found in different regions, as I believe this to be

too hazardous a task. Attempts to correlate the different stages of the Siwalik-fauna with those of european deposits have been made by Pilgrim (1932, pp. 6—8), Matthew (1929, pp. 438—443, fig. 1) and Colbert (1935, p. 378). For the problem whether the forms enumerated are valid species, the age of the deposits from which they were collected is irrelevant.

Under each species the characters are mentioned in which it appears to differ from the javan fossil.

Crocuta borissiaki (Khomenko)

Hyaena borissiaki Khomenko, 1932, p. 81, pls. 1—9; Schreuder, 1935, p. 80.

Horizon: Middle Pliocene of Bessarabia.

The mandible is lower and more gradually curved posteriorly.

Crocuta brevirostris (Aymard)

Hyaena brevirostris, Boule, 1893, p. 85, pl. 1; Mayet & Roman, 1923, pp. 31, 52, 63.
Hyaena robusta, Weithofer, 1889, p. 346, pl. 3 figs. 1, 2.

Boule (1893, p. 93) and Mayet & Roman (1923, p. 52) refer *H. robusta* Weithofer to the synonymy of *brevirostris*; Pilgrim (1931, p. 115) considers it to be a variety of *C. brevirostris.* Bernsen (1931, p. 156), however, believes *robusta* to be a race of *C. perrierii* (vide infra).

Horizon: Upper Pliocene of Europe (Pilgrim, 1931, p. 115).

The mandible is not so high as in the javan fossil, and the lower border is more gradually curved. The foramen mentale is placed more anteriorly in *C. brevirostris* (Boule, 1893, pl. 1) (occasionally two mental foramina may be present, Weithofer, 1889, pl. 3 fig. 2).

Crocuta carnifex (Pilgrim)

Crocuta carnifex, Pilgrim, 1932, p. 111 (measurements), p. 141, pl. 7 figs. 1, 1a, 3, 3a, 4, 4a, 12, 12a; Colbert, 1935, p. 112, fig. 51.

According to Colbert this species is closely allied to *C. variabilis* (Zdansky).

Horizon: Chinji zone (Colbert, 1935, p. 112), Lower Siwaliks, Dhok Pathan zone (Pilgrim, 1932, p. 111), Middle Siwaliks.

Judging by the measurements of the teeth and of the diastema (Pilgrim, 1932, pp. 111, 140) this is a smaller species. The diastema measures 6 mm in *C. carnifex,* while in the javan jaw it measures 15.2—17.3 mm approximately. Moreover *C. carnifex* has a well developed anterior cusp on P_3.

Crocuta colvini (Lydekker)

Hyaena colvini Lydekker, 1884, pp. 290, 296 (measurements), pl. 38 fig. 3; Matthew, 1929, p. 491.
Crocuta colvini, Pilgrim, 1932, p. 139, pl. 10; Colbert, 1935, p. 112.

Matthew (1929, p. 491) and Colbert (1935, p. 112) believe that this species may be a small variety of *C. sivalensis* (v. Meyer).

Horizon: Pinjor Stage, Upper Siwaliks (Pilgrim, 1932, p. 139).

In this species the jaw is much lower; the length of P_4 is not contained twice in the depth of the mandible at M_1.

Crocuta crocuta (Erxl.)

A great number of recent forms of spotted hyaenas have been described as species; they appear to be entitled to subspecific rank only, and a revision based on adequate material will probably show that the number of these forms must be greatly reduced (Grimpe, 1916, pp. 54—55; Hollister, 1918, pp. 143—145; Allen, 1924, pp. 217—220).

From the recent jaws of *Crocuta crocuta* which I examined the javan fossil differs in the shape of the mandible which is much lower anteriorly in *C. crocuta.*

Crocuta crocuta spelaea (Goldfuss) [1])

Hyaena crocuta, Var. *spelaea*, Abel, 1922, p. 49.
Hyaena crocuta spelaea, Pei, 1934, p. 22.
Hyaena crocuta, Weithofer, 1889, pl. 4 fig. 5; Reynolds, 1902, pl. 2 fig. 2, pl. 3 figs. 2, 3.

Horizon: Pleistocene of Europe, Northern Africa and China; prehistoric deposits of Egypt (Gaillard, Arch. Mus. Hist. Nat. Lyon, vol. 14, no. 3, 1934, pp. 1—125, non vidi; fide Zool. Record for 1935).

As in the recent forms of *Crocuta crocuta* the jaw is more curved and lower anteriorly.

Crocuta eximia (Roth & Wagner)

Hyaena eximia, Mecquenem, 1925, pl. 5 (9) fig. 7; Arambourg & Piveteau, 1929, pl. 2 fig. 3.
Crocuta eximia, Pilgrim, 1931, pl. 1 fig. 1.

Horizon: Pontian of Europe and Persia; numerous localities are mentioned by Pilgrim (1931, pp. 116—117) to which may be added Spain (Roman, 1929, p. 202 and other authors).

The lower jaw is more curved and generally P_1 is present.

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1) The description of *Hyaena crocuta* var. *sicula* De Gregorio (Naturalista Sicilian., Palermo, vol. 23, 1916, pp. 100—102; fide Zool. Record for 1916, Mamm., p. 10) was not available to me.

Crocuta felina (Bose)

Hyaena felina, Lydekker, 1884, pl. 39 figs. 2, 2a; Matthew, 1929, p. 491.
Crocuta felina, Pilgrim, 1932, p. 137, pl. 10; Colbert, 1935, p. 111.

According to Matthew (1929, p. 491) and Colbert, (1935, p. 111) probably a synonym of *C. sivalensis* (v. Meyer).

Horizon: probably Pinjor Stage, Upper Siwaliks (Pilgrim, 1932, p. 137).

The lower border of the mandible curves upward more gradually.

Crocuta gigantea gigantea (Schlosser)

Hyaena gigantea Schlosser, 1903, p. 35, pl. 2 figs. 6—8; Pei, 1934, p. 120.
Crocuta gigantea, Colbert, 1935, p. 114.

Horizon: Pontian of China (Pilgrim, 1931, p. 115); uncertain (Pei, 1934, p. 120); Upper portion of Middle Siwaliks or Lower portion of Upper Siwaliks (Colbert, 1935, p. 114).

C. gigantea is larger than the javan fossil.

Crocuta gigantea latro Pilgrim

Crocuta gigantea var. *latro* Pilgrim, 1932, p. 111 (measurements), p. 146, pl. 7 figs. 11 and 11a, pl. 8 figs. 1 and 1a.
Crocuta gigantea latro, Colbert, 1935, p. 115.

Horizon: Middle Siwaliks (Pilgrim, 1932, p. 146).

This subspecies is smaller than the typical form; the mandible is more gradually curved than in the javan fossil.

Crocuta honanensis (Zdansky)

Hyaena honanensis Zdansky, 1924, p. 103, pl. 23 figs. 3, 4; Pei, 1934, p. 119.

Horizon: Hipparion Red Clay, Pontian or Lower Pliocene, China (Pei, 1934, p. 119).

The mandible is more gradually curved; P_1 present.

Crocuta licenti (Pei)

Hyaena sinensis, Teilhard de Chardin & Piveteau, 1930, p. 101, pl. 20 figs. 2, 2a.
Hyaena licenti Pei, 1934, pp. 110, 116, 120.

Horizon: Sanmenian of Nihowan or Upper Pliocene, China (Pei, 1934, p. 121).

Though the teeth of the lower jaw have been figured (Teilhard de Chardin & Piveteau, 1930, pl. 20 figs. 2, 2a) these figures do not permit conclusions to be made as to the differences that may exist between *C. licenti* and the javan fossil.

Crocuta mordax Pilgrim

Crocuta mordax Pilgrim, 1932, p. 111 (measurements), p. 150, pl. 7 figs. 10, 10a, pl. 10; Colbert, 1935, p. 115.

According to Colbert probably synonymous with *C. gigantea* (Schlosser) or *C. gigantea latro* Pilgrim.

Horizon: Dhok Pathan, Middle Siwaliks (Pilgrim, 1932, p. 150).

This species has a distinct anterior cusp on P_3; the jaw appears to be lower.

Crocuta perrierii (S. G. L.)

[Bravard,] Croiset & Jobert, 1828, pt. 8, pl. 1 figs. 5, 12, pl. 2.
hyène de Perrier, Croizet & Jobert, 1828, text, p. 178.
H(yaena) Perrierii S. G. L., 1829, p. 119.
Hyaena Perrierii, von Meyer, in: Bronn, 1848, p. 597.
Hyaena Perrieri, Boule, 1893, p. 94.
Hyaena perrieri, Mayet & Roman, 1923, pp. 31, 52; Bernsen, 1931, p. 153, pl.
Crocuta perrieri, Pilgrim, 1931, p. 115.
Hyaena topariensis, Weithofer, 1889, pl. 1 figs. 1—4.

Horizon: Upper Pliocene of Europe (Pilgrim, 1931, p. 115).

Generally Croizet & Jobert are cited as the authors of this species; this is incorrect, however. [Bravard,] Croiset & Jobert (1828) figured this species without giving it a valid scientific name. Croizet & Jobert (1828, p. 178) mentioned the species as "hyène de Perrier". Sherborn (1929, p. 4865) cites Bronn as the author, but this is incorrect too, for 1° the article on the genus *Hyaena* in Bronn (1848, p. 597) is signed M, indicating that it was written by von Meyer (cf. Bronn, 1848, p. LXXXIV) [1]), and 2° the name *Hyaena Perrierii* was first used by S.G.L. (1829, p. 119), who, when reviewing Croizet & Jobert's book, gave this name to the "Hyène du Perrier".

Boule (1893, p. 94) and Mayet & Roman (1923, pp. 31, 52) consider *Hyaena topariensis* Major to be a synonym of *perrierii.* Pilgrim (1931, p. 115) believes *topariensis* to be a variety of the latter. Bernsen (1931, p. 156) considers *H. robusta* Weithofer to be a variety of *perrierii*; other authors, however, refer *robusta* to the synonymy of *Crocuta brevirostris* (Aym.).

Judging by the figure of the mandible of *C. perrierii* ([Bravard,] Croiset & Jobert, 1828, pl. 2 fig. 3) the jaw of this species is lower than in the javan fossil. The mandible of *Hyaena topariensis* as figured by Weithofer (1889, pl. 1) is lower too.

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1) This is also the case with other specific names attributed to Bronn, e.g., *Felis subhimalayana* v. Meyer (in: Bronn, 1848, p. 492) (Pilgrim, 1932, p. 196).

Crocuta pilgrimina Rao

Crocuta pilgrimina Rao, 1932, p. 101, figs. (fide Zool. Record for 1934, Mamm., pp. 38, 80).

Horizon: Pleistocene, India.

Description not seen.

Crocuta salonicae (Andrews)

Crocuta salonicae, Pilgrim, 1931, p. 123.

Horizon: Pontian of Macedonia.

No lower jaw known.

Crocuta sinensis (Owen)

Hyaena sinensis, Zdansky, 1927, p. 22, textfigs. 3, 4; Zdansky, 1928, p. 42, textfig. 3, pl. 3 figs. 16, 17, pl. 4 figs. 3, 4; Pei, 1934, pp. 91, 121, textfigs. 27, 29a—f, 30, 31, pl. 15 figs. 3a, 3b, pl. 16 figs. 2a, 2b, pl. 20 figs. 1—6.

Hyaena ultima, Zdansky, 1925, p. 14 (part.), pl. 3 figs. 1, 2.

Horizon: Lower Pleistocene of Fuminhsien, Yunnan; Lower Pleistocene (Choukoutienian or Choukoutien Formation) of Choukoutien and Pleistocene (?) of Changchihhsien of Shansi (Pei, 1934, pp. 121—122).

The premolars are more massive; the lower border of the mandible is less straight than in the javan specimen; the symphysis projects not so far downward; in this respect the javan fossil is approached, however, by the old specimen of *C. sinensis* figured by Zdansky (1928, textfig. 3). The height of the mandible at M_1, in relation to the length of P_4, appears to be slightly less than in the javan mandible (about 2 × the length of P_4 in *sinensis,* somewhat more than 2 × this length in the javan mandible). Also the shape of the fossa masseterica is slightly different.

Crocuta sivalensis (v. Meyer)

Hyaena, Baker, 1835, p. 569, pl. 46 figs. 22, 23 [1]).

Hyaena Sivalensis v. Meyer, in: Bronn, 1848, p. 597 [2]); Falconer & Cautley, in: Falconer, 1868, p. 548.

Hyaena sivalensis, Matthew, 1929, p. 489 fig. 26.

Crocuta sivalensis, Pilgrim, 1932, p. 136 pl. 10.

Croucta sivalensis, Pilgrim, 1932, p. 134 (err. typ.).

Hyaena felina, Lydekker, 1884, pl. 38 fig. 1.

Horizon: probably Pinjor Stage, Upper Siwaliks (Pilgrim, 1932, p. 135).

Matthew (1929, p. 489) attributed the first use of the specific name

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1) This plate erroneously is numbered XLVII, this number occurring on two consecutive plates.

2) This reference appears to have been overlooked by Sherborn (1930).

sivalensis to Falconer & Cautley (in Falconer, 1868, p. 548); this is not correct, however, as von Meyer (in: Bronn, 1848, p. 597) had already given the name *Hyaena sivalensis* to the species figured by Baker (1835, p. 569, pl. 46 figs. 22, 23).

Judging by Lydekker's figure (1884, pl. 38 fig. 1) the mandible is more curved, and in relation to the length of P_2 it is lower anteriorly.

Crocuta ultima (Matsumoto)

Hyaena ultima, Zdansky, 1927, p. 20, pl. 2 figs. 4, 5; Pei, 1934, p. 122, pl. 12 fig. 5, textfig. 36.
Hyaena utima, Pei, 1934, p. 116 (err. typ.).

Horizon: Upper Phase of Choukoutien Formation (Lower Pleistocene) and Upper Cave of Choukoutien (Late Pleistocene); Lower Pleistocene of Ssuchuan (Matsumoto); Pleistocene (?) of Hsinanhsien of Honan (Pei, 1934, p. 122).

The mandible is lower.

Crocuta variabilis (Zdansky)

Hyaena variabilis Zdansky, 1924, p. 93, pl. 18 figs. 3, 4, pl. 20 figs. 3, 4; Pei, 1934, p. 119.

Horizon: Hipparion Red Clay Pontian (or Lower Pliocene), of Shansi, N. Shensi, and Kansu, China (Pei, 1934, p. 119).

This species represents perhaps a chinese race of *Crocuta eximia* (Roth & Wgn.) (Pilgrim, 1931, p. 117).

P_1 usually present; judging by Zdansky's figure (pl. 20 fig. 3) the mandible is lower.

Crocuta zdanskyi (Pei)

Hyaena zdanskyi Pei, 1934, p. 110, pl. 15 figs. 1a, 1b, pl. 16 fig. 1, pl. 20 fig. 7.

Horizon: Upper Polycene of Sinanthropus site at Choukoutien (Pei, 1934, p. 115).

The figures of the lower teeth do not permit conclusions as to the possible differences between this species and the javan fossil.

The differences noted in many cases are slight and may prove to be of little importance as the shape of the mandible is subject to rather great changes during growth. The systematic position of the javan species, therefore, remains somewhat doubtful. So long as it cannot be proved with any certainty that it is identical with one of the species from the asiatic continent it is regarded safer to recognize it as a distinct species.

Its synonymy is:

Crocuta (?) bathygnatha (Dubois)

Hyaena felina, Dubois, 1891, pp. 94, 95; Anonymus, 1891, p. 14.
Hyaena, Dubois, 1907, p. 454; v. Koenigswald, 1935, p. 191.
Hyaena bathygnatha Dubois, 1908, p. 1265; Stremme, 1911a, p. 55; Stremme, 1911b, p. 141; von Koenigswald, 1933, p. 21; von Koenigswald, 1934, p. 196; Raven, 1935, p. 261.
? *Hyaena sinensis,* von Koenigswald, 1935, p. 68, textfigs. 3, 4.

In a previous paper I (Brongersma, 1935, p. 56) have shown that the "*Hijaena*" recorded from Trinil (Anonymus, 1893, p. 15) in reality was a lower milkcarnassial (p_4) of a tiger, *Panthera tigris* (L.) sp.

The age of the deposits from which the hyaenid remains were taken has not yet been definitely settled. The different points of view have been enumerated in my paper on the Felidae from these deposits (Brongersma, 1935, p. 1). Von Koenigswald (1935) believes the deposits at Sangiran which yielded the hyaenid teeth described by him to belong to the Lower Pleistocene (Djetis-Fauna).

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1) This work generally is attributed to Croizet & Jobert as only authors. On the wrappers of the first seven parts Bravard is mentioned as one of the authors. Part 8 mentions only Croiset & Jobert as authors; the wrapper bears a notice that the drawings were no longer made by Bravard. The latter (A. Bravard, Monographie de la Montagne de Perrier, près d'Issoire (Puy-de-Dome) et de deux espèces du genre Felis, découvertes dans une de ses couches d'alluvion. 1 map, 2 pls., 147 pp., Paris; pp. 138—139) wrote that he was actually the author of the first eight parts of the "Recherches". Indeed most of the plates are signed by Bravard, e.g., four out of the five plates of pt. 8. It appears, therefore, to be only reasonable to cite Bravard as one of the authors of pt. 8. Sherborn, (1922, p. XL) mentions that the "Recherches" were published in eight parts, the text being published in pt. 8. This appears to be incorrect, as a copy belonging to the Roman Catholic Highschool at Leiden, and which I could examine through the courtesy of the Rev. Fthr. Zonderland O.F.M., consists of nine parts containing plates, and one volume text, all still having the original wrappers.

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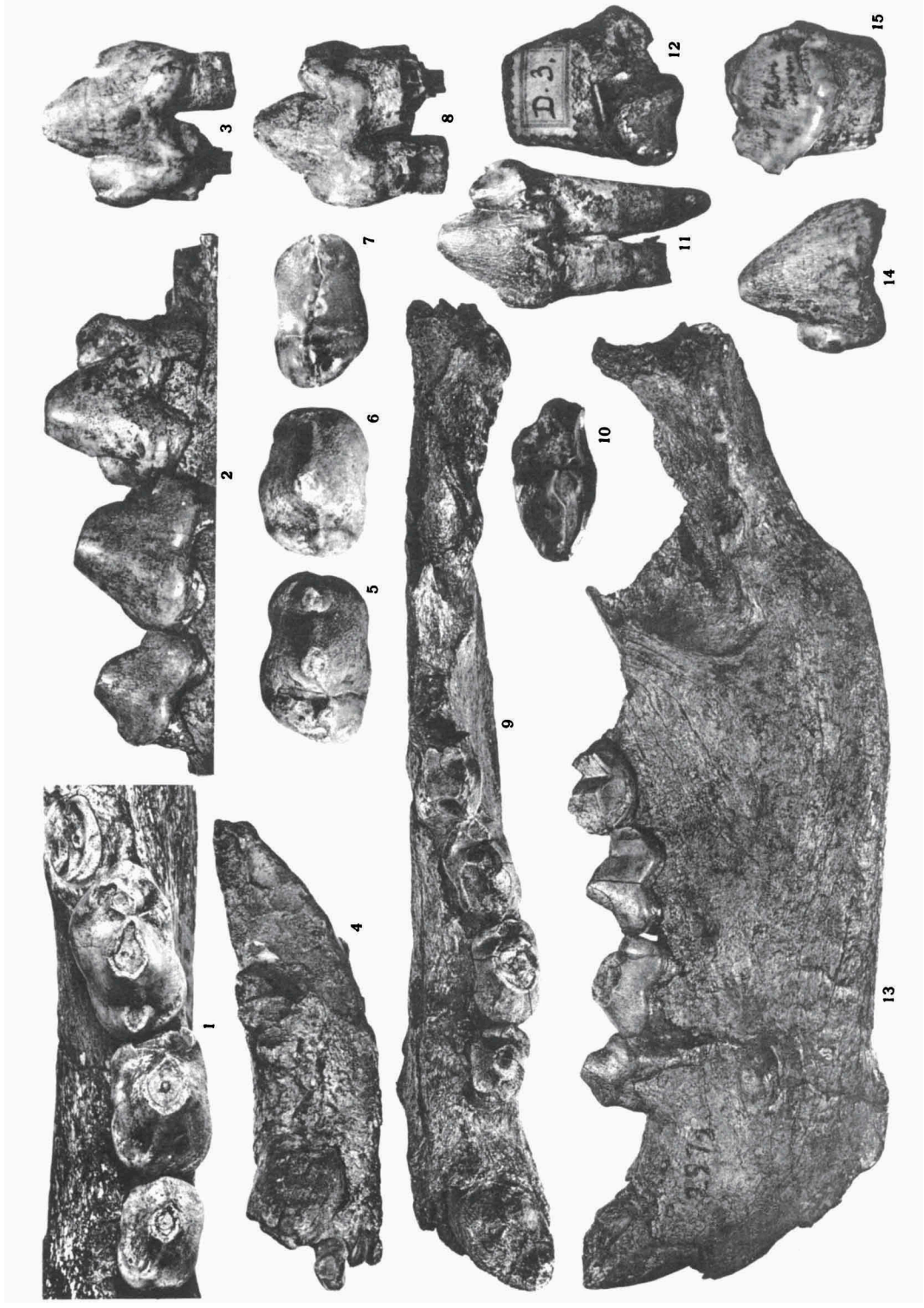
EXPLANATION OF PLATE XIII

Crocuta (?) bathygnatha (Dubois)

Fig. 1, lower cheekteeth, Kedoeng Broeboes, Coll. Dubois, reg. no. 2575, upper view.
Fig. 2, id., buccal view.
Fig. 3, right P_4, Kebon Doeren, Coll. Dubois, reg. no. 2574, buccal view.
Fig. 4, fragment of right mandible, Kebon Doeren, Coll. Dubois, reg. no. 2573, upper view.
Fig. 5, right P_4, Kebon Doeren, Coll. Dubois, reg. no. 2574, upper view.
Fig. 6, right P_3, Kebon Doeren, Coll. Dubois, reg. no. 2574, upper view.
Fig. 7, left P_4, Tegoean, Coll. Dubois, reg. no. 11238, upper view.
Fig. 8, right P_4, Kebon Doeren, Coll. Dubois, reg. no. 2574, lingual view.
Fig. 9, left mandible, Kebon Doeren, Coll. Dubois, reg. no. 2573, upper view.
Fig. 10, fragment of right P^4, Tegoean, Coll. Dubois, reg. no. 11238, lower view.
Fig. 11, left P_4, Tegoean, Coll. Dubois, reg. no. 11238, buccal view.
Fig. 12, fragment of right P^4, Tegoean, Coll. Dubois, reg. no. 11238, buccal view.
Fig. 13, left mandible, Kebon Doeren, Coll. Dubois, reg. no. 2573, lateral view.
Fig. 14, right P_3, Kebon Doeren, Coll. Dubois, reg. no. 2574, buccal view.
Fig. 15, fragment of right M_1, Kebon Doeren, Coll. Dubois, reg. no. 2574, buccal view.

Figs. 4, 9, 13, $\times$ $^2/_3$; all other figures: natural size.



H. CORNET phot.