MEMOIRS

OF THE

GEOLOGICAL SURVEY OF INDIA.

Palæontologia Indica,

BEING

FIGURES AND DESCRIPTIONS OF THE ORGANIC REMAINS PROCURED DURING THE PROGRESS OF THE GEOLOGICAL SURVEY OF INDIA.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE GOVERNOR GENERAL OF INDIA IN COUNCIL.

Ser. X.

INDIAN TERTIARY AND POST-TERTIARY VERTEBRATA.

Vol. III.

By R. LYDEKKER, B.A., F.G.S., etc.

CALCUTTA:

SOLD AT THE

GEOLOGICAL SURVEY OFFICE, AND BY ALL BOOKSELLERS:

LONDON: TRÜBNER & CO.

MDCCCLXXXIV.—LXXXVI.

PRINTED BY GIBBS AND BAMFORTH, ST. ALBANS, HERTS.

PREFACE.

The present volume completes the description of the Siwalik and Narbada Vertebrata as at present known, although one or more supplemental memoirs on particular groups may probably be published; while materials for others may, it is hoped, be afforded by future 'finds.'

My own share in the work commenced in 1876, and its completion has therefore taken upwards of ten years. The general advance in vertebrate zoology and palæontology during that period, coupled with the disadvantage of my not having had access to the British Museum collections when writing the first and part of the second volumes, and my own inexperience when I commenced the work, has entailed many changes both in systematic arrangement, and in the determination of particular specimens; but the Synopsis of Mammalia given in this volume, together with the Introductory Observations, will, it is hoped, render all such emendations apparent to the reader.[1] The publication of Prof. W. H. Flower's 'Catalogue of Mammalia in the Museum of the Royal College of Surgeons' (1884) marks an epoch in the history of the Mammalia, as being one of the first attempts to introduce a thoroughly dependable nomenclature, and the generic terms employed in the synopsis in the present volume have been brought in the main into accord with those used in that work. The lines laid down in that Catalogue have been followed in my own 'Catalogue of the Fossil Mammalia in the British Museum', now in course of publication; and the writing of that work has enabled me to make numerous emendations in regard to the species and range of the non-Indian mammals referred to in the course of this and the preceding volumes. Some of these emendations are noticed in the Introductory Observations to the present volume, but the reader who desires to quote any observations in regard to such mammals is referred to the original work. In both the above-mentioned Catalogues generic terms have been

1 See also "Catalogue of Siwalik Vertebrata in the Indian Museum," pt. I. *Calcutta* (1885).

employed in a very wide sense, and I am more and more convinced that this view is the preferable one, as the multiplication of such terms can but encumber the science without giving any adequate advantage in return.

I may mention that the references to non-Siwalik vertebrates do not usually refer to the first publication of the names, but merely to good descriptions or figures.

I have again to express my thanks to many of the Officers of the Zoological and Geological Departments of the British Museum (Natural History) for much valuable assistance; and thanks are also due to the Director of the British Museum, and to Professor Boyd-Dawkins, of Owens College, for some of the woodcuts illustrating this volume. The readers of this and the preceding volume are deeply indebted to Miss G. M. Woodward and the other artists for the accuracy and excellent execution of the figures of the specimens.

RICHARD LYDEKKER.

The Lodge,
Harpenden,
Hertfordshire.

March 1*st*, 1886.

INTRODUCTORY OBSERVATIONS.

ADDENDA TO SYNOPSIS OF SIWALIK & NARBADA MAMMALIA.

General.—Since the publication of the Synopsis of Siwalik and Narbada Mammalia in the third part of the present volume several new upper Siwalik species have been added to the list, and some emendations made in regard to certain genera and species; while there is one provisional new species to be added. All these additions are noticed in the sequel; the genera being taken in the same order as in the Synopsis. It may be premised that the division of the Artiodactyla into the sections Ruminantia and Suina, and of the latter into the subsections Selenodontia and Bunodontia has been abandoned.[1]

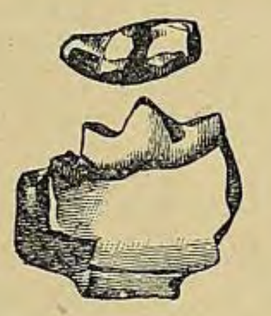

Fig. 1. *Mustela*, sp Fragment of the left ramus of the mandible; from the Siwalik Hills. British Museum (No. 15914).

Mustela, *sp.* – This form (*infra.* p. 125) is determined from a fragment of the left ramus of the mandible (woodcut fig. 1), which is described and figured on page 177 of part I. of the "Cat. Foss. Mamm. Brit. Mus." It indicates a species as large as *M. flavigula*.

Nesokia, *sp.*—The specimen alluded to in the synopsis (*infra.* p. 126) as *Mus.* (?), sp. is referred in the "Cat. Foss. Mamm. Brit. Mus.' part I. p. 226 to *Nesokia*; it presents no characters by which it can be distinguished from *N. hardwickei*, Gray.

Lepus, *sp.*—The fragment of the mandible of a *Lepus* mentioned in the synopsis (*infra.* p. 126) is described in the "Cat. Foss. Mamm. Brit. Mus." pt. I. p. 262.

Bubalus buffelus.—The so-called *B. palæindicus* (which occurs only in the topmost Siwaliks and the Narbadas) is referred to a variety of this species (*vide* "Cat. Foss. Mamm. Brit. Mus." pt. II. p. 28).

Hemibos.—This genus (including three species) is now merged in *Bubalus* (*vide* "Cat. Foss. Mamm. Brit. Mus." pt. II. p. 28).

Strepsiceros (?) falconeri, *Lyd.*[2]—This is a new species founded on part of a cranium from Perim Island (*vide* "Cat. Foss. Mamm. Brit. Mus." pt. II. p. 47).

Hippotragus sivalensis, *Lyd.*—The so-called *Antilope sivalensis* (*vide infra.* p. 128) is referred to *Hippotragus* (*vide* "Cat. Foss. Mamm. Brit. Mus." pt. II. p. 49).

Cobus.—Two species have been referred to this genus, *viz.* the so-called *Antilope* (?) *patulicornis*, Lyd. (*vide infra.* p. 128); and a new species named *C. palæindicus*, Lyd.[3]

1 See part II of the writer's "Catalogue of Fossil Mammalia in the British Museum" (1885) and part I. of "Catalogue of Siwalik Vertebrata in the Indian Museum" (Calcutta, 1885). A few emendations in the references to the original descriptions of Siwalik mammals have been made in these works.

2 'Geol. Mag.' dec. 3. vol. II. p. 170 (1885).

3 "Cat. Foss. Mamm. Brit. Mus. pt. II. p. 53 (1885).

clusion that *H. antilopinus* was probably monodactylate; and also that the remains from the Punjab described and figured in the second volume of this work under that specific heading not improbably belong to a distinct species.

Rhinoceros and Aceratherium.—The writer has come to the conclusion that there is no logical reason for generically separating *Accratherium* from *Rhinoceros* (*vide* "Cat. Foss. Mamm. Brit. Mus." pt. III.[1]), since the American forms ranged by Cope under the names *Aphelops*, *Cœnopus*, and *Peraceras* (*vide supra* vol. II. p. ix.) indicate a complete transition between the two.

Mastodon cautleyi, *n. sp. Lyd.*—The difficulty of referring detached teeth of the genus *Mastodon* to their proper species in cases where several allied forms occur in the same formation is so great, that errors in such determinations are almost inevitable unless a very extensive series of perfect specimens is forthcoming. In recently describing a molar of *Mastodon latidens* from Borneo, the present writer[2] referred to certain Siwalik specimens in the British and Indian Museums which appeared to indicate a more or less complete transition between typical molars of that species on the one hand and those of *M. perimensis* on the other. A subsequent examination of the specimens in question has however led to the conclusion that they cannot apparently be satisfactorily referred to either one of those species; and as there can be no question as to the strongly marked distinction between typical molars of those two species, it has been thought, after considerable hesitation, advisable to provisionally apply a distinct specific name to the aberrant form, which may be called *M. cautleyi*. The alternative would be to consider this form as a variety of one of the previously named species, but the difficulty then arises of saying with which it should be associated, since its upper molars present resemblances not only to those of the Siwalik *M. latidens* and *M. perimensis*, but also to those of the European *M. longirostris*.

The specimens on which this provisional species is founded are five in number, and are all cheek-teeth of the upper jaw; four of them being in an unworn condition. Three of these teeth, which are all from Perim Island, are in the British Museum, and are figured in the "Fauna Antiqua Sivalensis," under the name of *M. latidens*: the first (pl. XL. figs. 2, 2a) is the right mm. 4; the second (pl. XL. figs. 3, 3a) is the left m. 1, and is refigured of the natural size in woodcut fig. 5; while the third (pl. XXXI. figs. 6, 6a) is the left m. 3, and is refigured on a larger scale in woodcut fig. 6. The other two specimens are in the Indian Museum, and are figured in the present work under the name of *M. perimensis*; the first[3] (vol. I. pl. XL.) being the partially-worn left m. 1, with the associated pm. 4, the former[4] of which apparently agrees precisely with the homologous British Museum specimen, and the other[5] (vol. III. pl. XVI. fig. 2) the imperfect right m. 2, in an unworn condition. All these

1 In preparation.

2 'Proc. Zool. Soc.' 1885, pl. XLVIII.

3 "Cat. Siwalik Vert. Ind. Mus." pt. I. p. 97. No. A. 48. (1885). *M. perimensis.*

4 When describing this specimen in Calcutta the writer could not identify it with the one figured in the "F.A.S." pl. XL. fig. 3, owing to the small size of the figures in that work, which renders them almost useless for comparison.

5 "Cat. Siwalik Vert. Ind. Mus." pt. I. p. 97. No A. 437. (1885). *M. perimensis.*

INDIAN TERTIARY & POST-TERTIARY VERTEBRATA.

ADDITIONAL SIWALIK PERISSODACTYLA & PROBOSCIDIA.

By R. LYDEKKER, B.A., F.G.S., F.Z.S.

(WITH PLATES I. to V.)

INTRODUCTORY.

Since the publication of the supplementary memoir on Siwalik Proboscidia, and the memoirs on the *Rhinocerotidæ* and *Equidæ* in the preceding volume of this work, other remains of these groups from the Siwaliks have been acquired by, or lent to, the Indian Museum. Some of these later acquisitions belong to one or more new species; others to a species new to India; while others illustrate more fully than heretofore a previously known Indian species.

In the present memoir the most important of these new specimens are described and figured; and in order to illustrate their affinities more fully, the figures of certain specimens from the earlier volumes have been reproduced by the side of those of the new specimens.[1]

Since lists of species, together with the chief dental characters of the genera treated of in this memoir, have been already given in the two preceding volumes, the description of the species may be undertaken without preliminary matter.

It will save space to mention here that, with the exception of the remains of *Hippotherium*, the whole of the specimens[2] forming the subject of the present memoir were collected in 1882 by Mr. W. T. Blanford from the lower Siwaliks, or Manchhars, of the extreme western side of India; the two most important localities being Gandoi, in the Búgti Hills, north of Jacobabad, in Sind; and Dera Búgti, on the north-eastern frontier of Balúchistân.

1 An additional reason for reproducing some of these figures was their unsatisfactory execution.

2 These do not of course include the specimens from the tertiaries of other districts figured to illustrate more fully the affinities of Mr. Blanford's specimens.

ORDER: UNGULATA.[1] SUB-ORDER: PERISSODACTYLA.

FAMILY: *RHINOCEROTIDÆ.*

GENUS: ACERATHERIUM, Kaup.

Species: ACERATHERIUM BLANFORDI, n. sp., *nobis.*

History.—In the preceding volume of this work a much battered left maxilla of a small rhinoceros from the Siwaliks of the Punjab, containing pm. 4, m. 1, and m. 2, is figured[2] and briefly described.[3] It was there pointed out that the specimen apparently came nearest to *R. palæindicus*, among the Siwalik rhinoceroses; and that if not the same, it indicated a new Siwalik species: it was, however, added that there did not seem "any evidence at present to warrant us in separating the two," and the Punjab specimen was, therefore, provisionally referred to *R. palæindicus.*

The evidence for the specific distinctness of the form to which this imperfect specimen belonged has been afforded by the more perfect specimens forming the subject of the present notice.[4]

Upper molars of larger race.—In plate I., fig. 1, there are represented the three left upper true molars of a rhinoceros from Dera Búgti; in which the well-worn condition of the masticating surface indicates that they belonged to a fully adult animal: the first and third teeth are somewhat damaged, but the middle tooth is perfect.

The latter tooth (of which another specimen from Gandoi, in a less worn condition, is represented in fig. 2 of the same plate) is characterized by the comparatively small development of the buttress[5] at the antero-external angle; so that the second costa (*c*) projects but slightly above the plane of the external surface (*dorsum*) of the crown; while the external surface of the first costa (*d*) is placed very nearly in the same plane. Behind the second costa the dorsum is distinctly concave, especially near the free edge, but this concavity is much less marked than in many species.[6] The crown is worn into an irregular concavity, as in most rhinoceroses. The anterior collis (*a*) is relatively large; and at a short distance from its inner extremity is constricted by a deep groove on either side. On the outer side of the hindmost of these grooves there is a bold ante-crochet (*f*), projecting into the median valley; the bottom of which is thus completely obstructed in the middle. Externally to this obstruction the median valley again expands and deepens; the form of the terminal portion being rounded in all early stages of wear.

1 In accordance with the classification recently proposed by Prof. Flower ('*Pro. Zool. Soc.*,' 1883, pp. 184-5) the Proboscidia will be reckoned as a sub-order of the Ungulata.

2 Plate VI., fig. 1. 3 Pages 44-45.

4 These specimens have been briefly noticed in the "Records" (vol. XVI., p. 72), when it was thought the mandible resembled that of the African species, which turns out not to be the case.

5 For these terms see vol. II., p. 8. 6 This concavity is most marked in the specimen represented in fig. 2.

At the entrance to the same valley there is a large, blunt tubercle (*g*) attached exclusively to the posterior collis (*b*). The latter gives off a blunt projection into the median valley, placed a short distance internally to the ante-crochet (*f*), and more externally a distinct, though small crochet (*e*): there is no combing-plate at the extremity of the median valley. The posterior valley (*i*) is elongated antero-posteriorly, and is much less deep than the median valley; the descent from its outer wall being gradual. The cingulum forming the anterior valley (*left of a*) does not extend beyond the inner half of the tooth; and in one specimen (fig. 2) stops short of the inner surface of the anterior collis, but in the other extends a short distance on to this part.

In the last molar (m. 3, fig. 1) the general characters are the same as in the preceding tooth: the anterior cingulum extends, however, still more on to the inner face of the anterior collis (*a*), and the tubercle at the entrance to the median valley is larger. The much worn first molar (m. 1, fig. 1) shows the median valley all but divided by the above-mentioned obstruction into two distinct portions, the inner of which is triangular, and the outer sub-elliptical in shape. An equally worn m. 1 from Gandoi represented in plate II., fig. 2, exhibits these characters still more clearly.

Upper cheek-teeth of smaller race.—In plate II., fig. 4, there is represented the left maxilla of a smaller rhinoceros from Gandoi, containing all the permanent cheek-teeth, with the exception of pm. 1, in a medium condition of wear; the first and last of the series being somewhat damaged. With the exception of their considerably smaller size the true molars of this specimen agree precisely with the teeth described above; and since there is a considerable variation in the size of different races of some of the existing species of rhinoceros, there appears no good reason for regarding the Gandoi specimen otherwise than as belonging to a small race of the species to which the larger teeth belong.

The premolars of this specimen have their inner halves surrounded by a complete, sharp-edged cingulum; whose free edge extends much higher up on the crown of the posterior (*b*) than on that of the anterior collis (*a*). The latter extends considerably more inwardly than the former; which is, so to speak, buried in the cingulum. With the exception that the ante-crochet is less developed, the other general characters of the premolars are similar to those of the true molars. In pm. 4 there is a small combing-plate.[1]

Comparisons with other Siwalik rhinoceroses.—A comparison of the figures of the specimens described above with the small maxilla represented in vol. II., pl. VI., fig. 1, will show pretty clearly that all belong to the same species, the Punjab specimen being intermediate in point of size between those figured in this volume. Accepting this identification, it remains to show in what respects these specimens differ from *Rhinoceros palæindicus*, with which, in the perhaps over anxiety to avoid making unnecessary species, the first specimen was provisionally classed. In the

1 There is another specimen of the same size from Gandoi in the Indian Museum (No. C. 266), exhibiting the three true molars of the right side in a much damaged condition.

true molars of the typical *R. palæindicus* (woodcut fig. 1[1]) the external surface is still flatter than in the present specimens; the buttress being entirely absent and the costæ (*c*, *d*) but faintly developed. The bases of the two colles (*a*, *b*) are, moreover, in contact, and there is no tubercle at the entrance to the median valley (*g*): nor is there any ante-crochet. In more worn teeth[2] the median valley becomes separated into two isolated fossettes[3]; the entrance to the valley becoming obliterated, instead of having the triangular, imperfectly isolated fossette which occupies that place in the teeth under consideration (pl. II., fig. 2). The tooth regarded as a premolar of *R. palæindicus* (vol. II., pl. VII., fig. 2) is quite different from the premolars of the specimen represented in pl. II., fig. 4, of this volume.

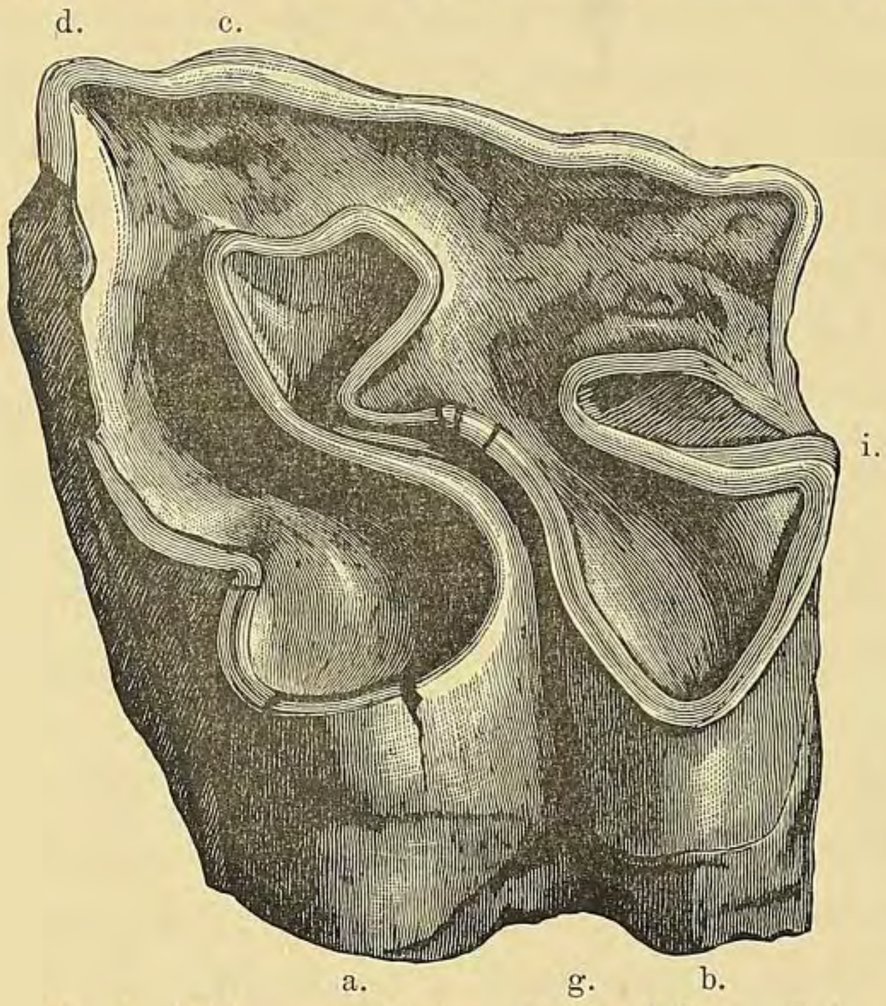

Fig. 1. *Rhinoceros palæindicus*, Falc. and Caut. 2nd upper true molar, from the Siwaliks: British Museum (No. 39,648): the tooth really belongs to the right side, but the figure has been reversed, so as to make it correspond with the teeth figured in plate I. $\frac{1}{1}$.

In the preceding volume[4] a skull of a small Siwalik rhinoceros in the British Museum (No. 48,932) was provisionally referred to *R. palæindicus*. The inner halves of the molars (which are alone preserved) differ, however, from those of that species by the separation of the bases of the colles, and the partial development of an ante-crochet: pm. 4 has, moreover, a distinct cingulum. Now that the specimen represented in vol. II., pl. VI., fig. 1, has been shown to be distinct from *R. palæindicus*: it seems pretty certain that the above-mentioned skull is likewise distinct. The last premolar of the latter is very like the corresponding tooth of the specimens under consideration; but the true molars have not such a marked ante-crochet and constriction of the anterior collis; and it, therefore, seems not improbable that this skull is likewise specifically distinct from the specimens under consideration, although the broken condition of its teeth does not admit of certain specific determination. Apart from the question as to the species of this skull it may be taken as pretty certain that the specimens under consideration do not belong to *R. palæindicus*; which is also distinguished by its greatly superior size.

Turning to *R. sivalensis*, it will be seen from the typical upper molar refigured

1 This specimen is also figured ($\frac{1}{2}$) in volume I., pl. IV., fig. 3, and in the "F.A.S.," pl. LXXV., fig. 4, as a premolar: it has been shown in vol. II. (p. 44) to be a true molar. The position in which this specimen is figured shows scarcely any of the external surface, which is well displayed in the specimens figured in the plates.

2 "F.A.S.," pls. LXXIV., fig. 1: LXXV., fig. 1.

3 In the previous volume (p. 44), from the inclusion of other specimens with this species, it was doubted whether this was invariably the case.

4 Page 45.

in plate I., fig. 7, that the buttress is much more strongly developed; the second costa (*c*) standing out more prominently, and the first costa (*d*) being placed more internally to the plane of the external surface of the crown, and more prominently developed. Again, the anterior collis (*a*) has no vertical groove on its posterior side, and the ante-crochet (*f*) is absent: the crochet (*e*) is also relatively larger, and the outer termination of the median valley in an early stage of wear[1] is triangular, instead of rounded. The posterior valley (*i*) of *R. sivalensis* forms a deep, round pit, instead of a shallow, elongated pit; while there is no tubercle at the entrance to the median valley (*g*). The figures of the more worn teeth of *R. sivalensis* given in the 'F.A.S.'[2] show that the fossettes formed on their crowns are quite different from those of the Búgti specimens. The premolars of the former species[3] are, moreover, quite distinct from those of the latter, having no cingulum on the inner side, and a well-developed second costa.

These comparisons leave no doubt of the well-marked distinctness of the present specimens from the typical race of *R. sivalensis*. In the second volume,[4] however, a right upper molar from Sind was described, presenting certain differences from the typical teeth of the last-named species; but apparently not such as, in the absence of other evidence, could be taken to justify specific distinction. This specimen is refigured in plate I., fig. 3. In the general contour of the crown, especially in the well-developed buttress and costæ, this tooth agrees with the typical molar of *R. sivalensis*. It differs, however, in that there is a groove on both sides of the anterior collis (*a*), with the consequent formation of a small ante-crochet; by the elongated and shallow form of the posterior valley (*i*); and by the presence of a rudimentary tubercle at the entrance to the median valley (*g*). In the same volume[5] another upper molar, of considerably smaller size, but presenting the same external contour of the crown, was described, and provisionally referred to *R. sivalensis* under the separate varietal name of *gajensis* (so named from the Gáj beds, in which it was found). This specimen is refigured in plate I., fig. 4. In this tooth the characters in which the last specimen differed from the typical molar of *R. sivalensis* are exaggerated; the ante-crochet being very distinct; the posterior valley (*i*) much elongated; and the tubercle at the entrance to the median valley (*g*) distinctly developed.

If the tooth represented in pl. I., fig. 3, had not been known, the Gáj tooth would have been certainly referred to a distinct species: but as the former, which in future it may be convenient to refer to as *R. sivalensis*, var *intermedius*, is precisely intermediate between the latter and typical teeth of *R. sivalensis*, it was found advisable to provisionally regard the three as races, or varieties, of the same species: this conclusion being strongly confirmed by the circumstance that the teeth regarded as the milk-molars of *R. sivalensis*[6] closely resembled the Gàj tooth.

It will be observed that the molars of *v. intermedius* and *v. gajensis* resemble the

1 Compare pl. I., fig. 2, with fig. 7; these specimens being in nearly the same stage of wear.

2 Plates LXXIV., fig. 5; LXXV., fig. 5. 3 *Supra.*, vol. II., pl. V., fig. 6. 4 Page 30. 5 Page 40.

6 Vol. II., pl. VI., fig. 2.

Búgti teeth much more closely than do those of the typical *R. sivalensis*. They are, however, at once distinguished by the greater development of the buttress and costæ; which stamp them as of the *R. sivalensis* type. The premolars of *v. intermedius* and *v. gajensis* are unfortunately unknown. The further consideration of the mutual relations of all these forms will come more conveniently in the sequel.

The molars of *Aceratherium perimense*, of which a specimen is represented in plate I., fig. 5 in nearly the same stage of wear as m. 2 in fig. 1 of the same plate, are distinguished from the Búgti teeth by the much greater development of the buttress and costæ (*c*, *d*), and the more marked sinuosity of the external surface of the crown. The ante-crochet (*f*) is less developed, and does not so completely block the median valley; while the posterior valley (*i*) forms a deep funnel-shaped pit, in place of a slit. The tubercle (*g*) at the entrance of the same valley is, moreover, attached to both colles (*a*, *b*); and in some instances[1] is crenulated; while there is no vertical groove on the anterior face of the posterior collis (*b*). The premolars of *A. perimense*[2] resemble the Búgti teeth in the presence of a cingulum; but are distinguished by the circumstance that this cingulum, which is frequently crenulated, does not extend across the inner face of the posterior collis; by the larger development of the second costa (*c*); and by the greater proportionate increase in the size of the later teeth of this series. *A. perimense* is also distinguished by its much larger size.

To the molars of *R. platyrhinus*[3] the Búgti teeth present no resemblance; and it is therefore apparent that they cannot be referred to any of the previously described species of Siwalik rhinoceroses. Further comparisons will be instituted in the sequel.

Mandible.—In figure 5 of plate II. there is represented a fragment of the left ramus of the mandible belonging to the same individual as the upper molars represented in fig. 4. The inner side shows the commencement of the symphysis immediately in advance of the socket of $\overline{\text{pm. 3}}$. Another specimen from Gandoi (woodcut fig. 2); which from its resemblance to the last specimen, and the locality

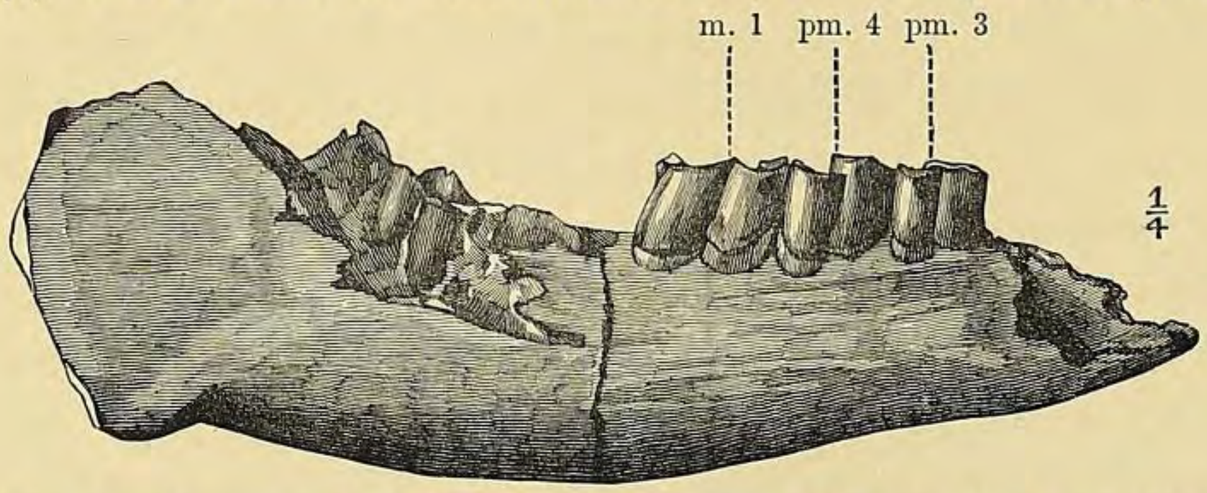

Fig. 2. *Aceratherium blanfordi*, Lyd. The right ramus of the mandible; from the lower Siwaliks of Gandoi: Indian Museum (No. C. 271).

from which it was obtained should almost certainly be referred to the larger race of the same species, shows a considerable part of the symphysis, and the alveolus of the right canine: while a third specimen from Gandoi (*Ind. Mus.*, *No.* C. 272) shows the hinder part of the symphysis, and the rami of both sides: the teeth and their alveoli and the extremity of the symphysis are, however, wanting. A fragment of

1 *Supra.*, vol. II., pl. II. 2 *Ibid.*, pls. II., IIA. 3 *Ibid.*, pl. VIII.

the right ramus of a calf, with one milk-molar remaining, is represented in plate II., fig. 3. The lower molars have a faint trace of an external cingulum. The inferior border of the horizontal ramus is markedly convex: and the ramus itself diminishes rapidly in vertical height towards, and at the symphysis,[1] indicating that the form of this part was very similar to that prevailing in the existing Javan rhinoceros, and that the canines[2] were of moderate size;—an inference rendered certain by the size of their alveoli in the specimen in which these are preserved. In the specimen figured in the woodcut the crown of $\overline{\text{m. 2}}$ has been hammered off; while $\overline{\text{m. 3}}$ is only partially protruded.

Upper milk-molars.—In figure 6 of plate I. there are represented the first and second right upper milk-molars of a rhinoceros from Gandoi, which may in all probability be referred to the present species. These teeth are of considerable importance in confirming the conclusions already arrived at as to the distinctness of the latter, since four other different types of upper milk-molars have been already described and referred to the four other Siwalik rhinoceroses.[3] The present specimens may be at once compared with the others, without preliminary description. In *R. palæindicus*[4] mm. 1 is more squared, and the anterior collis (*a*) is not distinctly developed: mm. 2 has no obstruction at the entrance to the median valley; and the extremity of the latter is cut off as an isolated fossette, which is not the case with the present specimen: minor differences will be detected by a comparison of the figures. In *R. sivalensis*[5] the external surface of mm. 2 is more convex, and wants the distinct costa which occurs opposite the median valley in mm. 2 of the present specimen[6]: the tooth which is probably mm. 1 of *R. sivalensis*[7] has a square crown, without any anterior prolongation. To mm. 2 of *R. platyrhinus*[8] the corresponding tooth of the present specimen has no resemblance. In *Aceratherium perimense*[9] mm. 2 has a squarer crown, with the two colles shaped more like those of the succeeding teeth: the median costa is also more strongly developed.

In figure 1 of plate II. there is represented the unworn germ of a right upper molar of a rhinoceros from Gandoi, which may possibly be the last milk-molar of the present species. It has lost the enamel of the anterior surface, and the first costa. The buttress was apparently more developed than in the true molars, giving the tooth a great resemblance to the molar of *R. sivalensis*, var. *gajensis*; from which it is, however, distinguished by its higher crown. The tooth has also a strong resemblance to mm. 4 of *R. sivalensis*, but has likewise a higher crown. If the serial and specific determination of this tooth be correct it indicates a resemblance between the milk-teeth of the typical *R. sivalensis*, of *var. gajensis*, and the present species, not existing in the true molars.

1 Seen even in the specimen represented in plate II., fig. 5, which is associated with the upper teeth of fig. 4.

2 Since it is now pretty clearly proved that the outer mandibular cutting teeth of the rhinoceroses are canines, and not incisors, they will in future be so termed.

3 Even if any of these milk-molars be wrongly assigned, this will not interfere with the inference drawn from the present specimens as to the existence of a fifth Siwalik rhinoceros.

4 *Supra.*, vol. II., pl. VII., fig. 3. 5 *Ibid.*, pl. VI., fig. 2. 6 Not clearly shown in the figure.

7 *Supra.*, vol. II., p. 34. 8 *Ibid.*, pl. VII., fig. 4. 9 *Ibid.*, pl. III., fig. 2: vol. I., pl. V., fig. 4.

Further comparisons.—Having now described all the known dental and mandibular remains of the present species; and its distinctness from the other named Siwalik species having been indicated; it remains to institute a wider range of comparisons. Commencing with the non-Siwalik Asiatic species, *R. deccanensis*[1] is distinguished by the absence of mandibular cutting teeth, and of an ante-crochet to the upper true molars, which are furnished with combing-plates. The upper premolars are, however, strikingly like those of the present species, but are distinguished by the greater development of the crochet, and the shape of the cingulum; which forms an inverted V, instead of an oblique line on the inner surface of the crown. The molars of *R. namadicus* are unknown. The last upper molar of the doubtfully distinct *R. sinensis*[2] has no ante-crochet.

Of the existing species, the large unicorn Indian rhinoceros is distinguished by its complex upper molars; while those of the Javan and Sumatran species[3] are of the *R. sivalensis* type. The two African species are distinguished by the absence of permanent cutting mandibular teeth; the same character also obtaining in *R. pachygnathus* of the Pikermi beds. The four species of the higher pliocene and pleistocene of Europe are likewise distinguished by the same character; as well as by the absence of pm. 1, which is shown by the specimen represented in plate II., fig. 4, to have been present in the Búgti species. It may be added that *R. tichorhinus* is widely distinguished by the complex structure of its upper molars[4]; while in *R. megarhinus*[5] (woodcut fig. 3), and *R. leptorhinus*,[6] Ow., the upper cheek-teeth have not such a distinct ante-crochet, such a stout cingulum to the premolars, or such a distinct tubercle at the entrance to the median valley; the crochet is moreover always larger. In *R. etruscus*,[8] which Prof. Boyd Dawkins considers to be allied to the miocene forms, the upper premolars have a well-developed cingulum, and a distinct ante-crochet exists in the true molars. This species is, however, readily distinguished by the cingulum of the premolars being less prominent, and running straight across the colles; both of which have the same inward extent. The

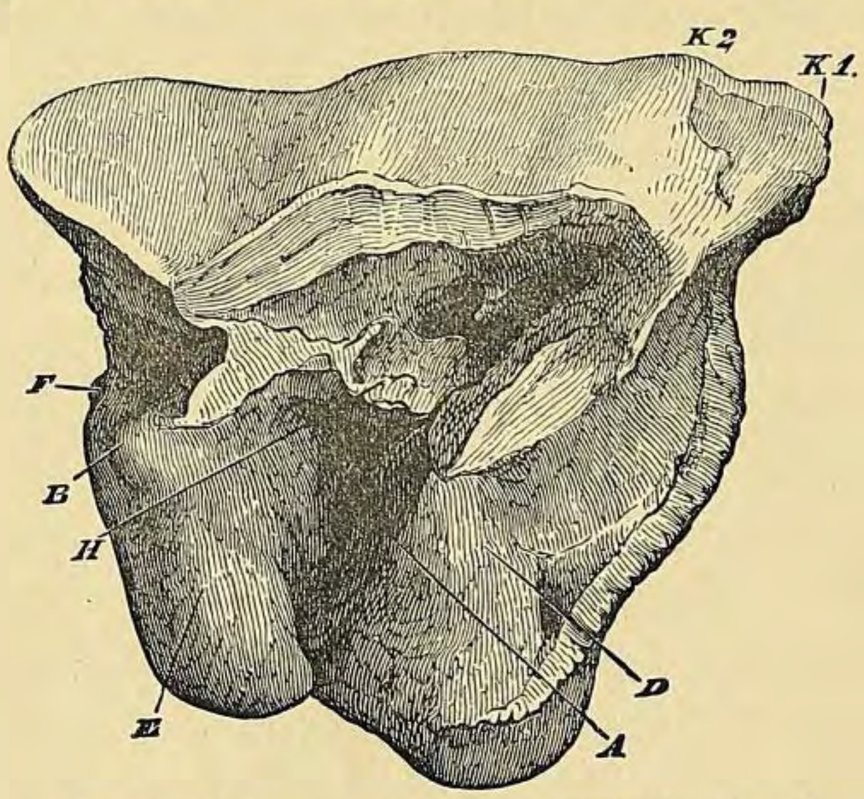

Fig. 3. *Rhinoceros megarhinus*,[7] Christol. Second right upper true molar, slightly worn. $\frac{1}{1}$. *A*, median valley; *D*, anterior collis; *E*, posterior do.; *F*, posterior valley; *H*, crochet; *K* 1, *K* 2, first and second costæ. Pleistocene, England.

1 *Supra.*, vol. I., p. 1, pls. I.—III.
2 Owen, 'Quart. Journ. Geol. Soc.,' vol. XXVI., pl. XXIX., fig. 1.
3 The so-called *R. lasiotis* and *R. inermis* are not distinguishable by dental characters from the Sumatran and Javan species.
4 Owen, "Brit. Foss. Mamm. and Birds," fig. 122, p. 329.
5 Lortet and Chantre, 'Arch. d. Mus. d'Hist. Nat. d. Lyon,' vol. II., pl. XVII.
6 Owen, *op. cit.*, fig. 141, p. 373.
7 The writer is indebted to Prof. Boyd Dawkins for this figure.
8 Boyd Dawkins, 'Quart. Journ. Geol. Soc.,' vol. XXIV., pl. VII.

ante-crochet of the true molars is also smaller; and the crochet of m. 3 extends nearly, or completely, across the median valley.

As it will be shown below that the Búgti teeth almost certainly belong to an *Aceratherium*, it will be unnecessary to point out the differences between them and the molars of the other species of *Rhinoceros*; none of which resemble them very closely: and further comparisons may accordingly be confined to *Aceratherium*. In *A. incisivum*[1] the upper molars very closely resemble the larger Búgti teeth; the general plan of structure being precisely the same: the buttress is, however, somewhat more developed, the first costa placed more internally, the crochet larger, the tubercle at the entrance to the median valley generally less conspicuous, and the ante-crochet rather smaller in the European form; these differences being most conspicuous in an early stage of wear.[2] The premolars of the two are almost indistinguishable; and the fossettes formed on the well-worn molars are likewise precisely similar. The mandible presents, however, considerable differences in the two forms; the inferior border of the horizontal ramus of the European species[3] being straight, and the ramus itself preserving nearly the same vertical thickness throughout its length. The lower canines are much larger, and the cheek-teeth have a more distinct cingulum. Although these differences are in all probability of sufficient importance to indicate the specific distinctness of the two forms, yet the resemblances are so strong as to render it certain that they were extremely closely allied; and it may, therefore, be inferred that the Búgti rhinoceros was in all probability an *Aceratherium*.

It does not appear that the upper molars of any other European species of that genus approach as closely to the Búgti teeth: those of *A. lemanense*,[4] and *A. croizeti*[5] being distinguished by the larger buttress, and the absence of the crochet; and the lower molars of the former[6] having a strongly developed cingulum. In *A. goldfussi*[7] the upper molars have a conspicuous buttress, as in *A. perimense*: the ante-crochet is very slightly developed, and there is no tubercle at the entrance to the median valley of m. 3. *A. velaunum*[8] is readily distinguished by its shortened mandible, and the peculiar form of its lower molars. The upper molars of *A. minutum*[9] have a large buttress, and apparently no distinct tubercle at the entrance to the median valley.

In the so-called *R. austriacus*, Peters,[10] of the middle miocene of Styria, which

1 Kaup, "Beiträge," pt. I., pl. IV. (the figure is very small, but being a photograph permits of enlargement with a lens: a cast of the original is in the British Museum). Blainville, "Ostéographie," Genus Rhinoceros, pl. XII. (*R. incisivus* de Sansan). The teeth in Kaup's specimen are slightly less worn than in the specimen represented in pl. I., fig, 1.

2 Compare pl. I., fig. 2, with fig. 62 (p. 58) of "Les Enchainements du Monde Animal—Mamm. Tert.": the two teeth are in about the same stage of wear.

3 Kaup, *op. cit.*, pl. 6. 4 Blainville, "Ostéographie," Genus Rhinoceros, pl. XII. (*R. incisivus* d'Auvergne).

5 Filhol, 'Ann. d. Sci. Geol.,' vol. XI., pp. 78-9. 6 Gaudry, *op. cit.*, fig. 59.

7 Kaup, *op. cit.*, pl. II. Gaudry, *op. cit.*, fig. 64 (*R. brachypus*).

8 Filhol, "Mammifères Fossiles de Ronzon," pl. XII. 9 Kaup, *loc. cit.*

10 'Denks. k. Ak. Wiss.,' vol. XXX., 1870, p. 46, pl. II. In the second volume of the present work this species is referred to *Rhinoceros*.

from the structure of its upper cheek-teeth probably belongs to *Aceratherium*, the upper premolars are readily distinguished from those of the Búgti species by the absence of an ante-crochet, the larger crochet, the more prominent second costa, the less complete cingulum, and the larger tubercle at the entrance to the median valley.

With regard to the American acerotheroids,[1] there is considerable difficulty in being perfectly sure that none of them are specifically the same as the Búgti form, owing to the circumstance that many of them have been only described in a preliminary manner, and that in many cases where figures have been given they are on such a small scale as to be useless for the detection of minute points of difference. It is, however, improbable that any one of the American forms should be specifically the same as an Indian species. Of those that have been figured the one that apparently comes nearest to the latter is *A. (Aphelops) fossiger*,[2] in which, as far as can be seen from the small figure, the upper molars have a very small buttress, and a large ante-crochet: but apparently no tubercle at the entrance to the median valley.

Specific distinctness and affinities.—As the result of the foregoing comparisons, it seems impossible to identify the Búgti rhinoceros with any described species; and it accordingly appears entitled to a separate specific name. The strong presumption that this species belonged to *Aceratherium* has been already indicated; and it is proposed that it should be known as *A. blanfordi*. The larger race may be distinguished as variety *majus*, and the smaller as variety *minus*. The remains of the former race indicate an animal somewhat exceeding in size full grown individuals of the typical Sumatran rhinoceros; while those of the latter are not larger than the small race of that form, which was named *R. niger* by Gray. As there is such an amount of variation in the size of the Búgti species, it has been thought that nothing would be gained by giving measurements. In the absence of the cranium it is impossible to say whether *A. blanfordi* was really hornless, but such was not improbably the case; although it is necessary to assume that those forms of the genus which come nearest to *Rhinoceros* were most probably furnished with a rudimentary nasal horn.[3] That the species was closely allied to *A. incisivum*[4] there can be no reasonable doubt; and there are also strong indications of its relation to the earlier races of the *R. sivalensis* type; a relationship of which traces are retained in the milk-molars of the later race of that type. It is, moreover, not impossible that the pleistocene *R. deccanensis* may have been a descendant from the same stock as *A. blanfordi*, since there is such a remarkable resemblance in the structure of their upper premolars. It is also conceivable that the small undetermined skull in the British Museum from the upper Siwaliks alluded to on page 4, may indicate a species connecting *A. blanfordi* with *R. deccanensis*, since there is a great similarity in the structure of their molars. The suppression of the buttress of the upper molars

1 *Supra*, vol. II., pp. 20, 21.

2 Cope, 'Amer. Nat.,' Dec., 1879, fig. 3, p. 771*e*.

3 The writer is convinced that it is almost or quite impossible to draw any real distinction between *Aceratherium* and *Rhinoceros*.

4 This species occurs in the Eppelsheim beds; and possibly in those of Pikermi and Mont Léberon.

which occurs in some of the most specialized recent and later tertiary rhinoceroses probably indicates that the stock of *A. perimense* (in which this buttress is strongly developed) diverged at an early stage from that of *A. blanfordi* (in which the buttress is small). It may be mentioned that the ante-crochet of the upper molars of the rhinoceroses is another feature which disappears in the later forms; being quite unknown in all those of the present day.

It thus seems probable that *A. incisivum*, *A. blanfordi*, and *R. sivalensis*, var. *gajensis* had a common ancestry in some part of the miocene; and that the latter form gave origin to var. *intermedius* of the lower Siwaliks, which overlie the Gáj beds, and that again to the typical *R. sivalensis* of the upper Siwaliks, from which the living Javan rhinoceros may have descended. The exact relationship of *A. blanfordi* to *A. incisivum* cannot yet be determined; neither is it certain in which direction the migration of the connecting forms took place. From the occurrence of the Gáj variety of *R. sivalensis* in the upper miocene of India, and that of *A. incisivum* in the upper miocene, and possibly in the lower pliocene, of Europe, and from the distribution of *A. blanfordi* (as noticed below), it seems, however, not improbable that the common ancestral form originated in the countries between India and Europe, and that the Styrian *A. austriacum* may be another branch of the same stock.

Distribution.—Remains of *A. blanfordi* have been obtained from the Punjab and the Búgti districts; and whereas the species appears to have been very rare in the former, it appears to have been as common in the latter area. This is noteworthy, since it would be expected that an Indian species exhibiting affinity with a European form would occur most abundantly on the western side of the Indian area.

A considerable part of the skeleton of the smaller race of the present species has been obtained and may perhaps form the subject of a future memoir.

Family: *EQUIDÆ.*

Genus: HIPPOTHERIUM, Kaup.

Species: Hippotherium antilopinum, Falc. and Caut.

Object of present notice.—A large series of the remains of this species (together with those of *H. theobaldi*) have been described in the third part of the second volume of the present work; but at that time no specimen of the cranium was known. This desideratum has been supplied by the specimen forming the subject of the present notice; which has been already briefly alluded to in the 'Records'[1] for 1883.

Cranium.—The cranium mentioned above is the property of Mr. Theodore Cooke, LL.D., F.G.S., of Poona, India, who has kindly lent it for description. It was obtained from the Siwaliks of Perim Island; and is represented, of half the natural size, in figures 1 and 2 of plate III.: the cheek-dentition of the left side

[1] Vol. XVI., p. 94.

being represented of the full size in fig. 3 of the same plate. The specimen has lost its two extremities, the crowns of the cheek-teeth of the right side, and the outer walls of some of those of the opposite side, but is otherwise in excellent preservation; many of the cranal sutures being distinctly visible. The condition of the teeth shows that the skull belonged to a fully adult, though not an old individual.

The grinding surfaces of the teeth cannot be completely cleaned from matrix; although this has been accomplished sufficiently to exhibit the complete isolation of the anterior pillar (*e*),[1] characteristic of *Hippotherium*; as well as the complex plication of the dentine and enamel in the central part of the crown, which is especially well-marked in both the Indian species described in the second volume. The anterior pillar (*e*) is less prominent and less elongated in cross-section than in the teeth of *H. theobaldi* figured in the same volume[2]; while the posterior pillar (*f*) is not constricted at its junction with the inner column, as is the case in little-worn teeth of that species,[3] and is larger than in well-worn teeth of the same.[4] In all these respects the teeth of the Perim skull agree with those of *H. antilopinum*[5]; as well as with the isolated tooth from the Punjab of which a polished transverse section is represented in plate III., fig. 4, of this volume. In the following table the dimensions of the Perim skull are compared with those of the three maxillæ referred to *H. antilopinum* in the second volume[6]; *viz.*:

	Previous specimens.			Perim skull.
Width of palate posteriorly			2·0	2·8
,, ,, ,, between pm. 4			1·9	2·6
Length of series of cheek-teeth	5·3			5·8
,, ,, three true molars	2·36		2·5	2·67
,, ,, pm. 2	1·25			1·25
Width ,, ,, ,,	0·83			
Length ,, ,, 3	0·96	0·96		0·96
Width ,, ,, ,,	0·95	0·95		1·04
Length ,, ,, 4	0·93	0·9	0·9	0·92
Width ,, ,, ,,	0·86	0·91	0·9	
Length ,, m. 1	0·8	0·81	0·8	0·88
Width ,, ,, ,,	0·85	0·88	0·9	
Length ,, ,, 2	0·85	0·82	0·8	0·87
Width ,, ,, ,,	0·76	0·72	0·85	0·93
Length ,, ,, 3	0·8		0·85	0·98
Width ,, ,, ,,	0·55		0·75	0·83

It will be observed that the teeth and palate of the Perim skull are somewhat larger than those of either of the other specimens, although the teeth are still considerably smaller than those of *H. theobaldi* figured in the second volume. It will also be observed that in the Perim skull the length of pm. 3 is less than its width, the reverse being the case in the other three specimens. Analogous differences prevail, however, in the latter, since the length of pm. 4 of the specimen in the first column exceeds its width, the reverse prevailing in the other two specimens: these differences need not,

1 For the terms employed in the description of the cheek-teeth of the horses, see vol. II., p. 73.
2 Plate XI., fig. 3. 3 *Ibid.* 4 Vol. II., pl. XIII., fig. 2.
5 *Ibid.*, pl. XI., fig. 1. "F.A.S.," pl. LXXXIII., fig. 18. 6 Page 76.

therefore, be of more than individual value, if all the three first specimens are correctly referred to the same species.

It appears from the foregoing comparisons and measurements that the Perim skull agrees so nearly with *H. antilopinum* that there seems no reason for assigning it to another species[1]; although its large size tends to remove one of the distinctions between that species and *H. theobaldi*.

Accepting the provisional reference of the skull under consideration to *H. antilopinum*, its distinctive characters will be exhibited in the best way, by at once comparing it with the skull of *H. gracile*. Regarding the teeth, no more need be said except that there are no signs of the presence of pm. 1; which exists as a small tooth in some specimens of *H. gracile*: this absence is the more remarkable since this tooth persists in both the Siwalik species of *Equus*. The Perim skull agrees with that of its European congener[2] in its comparatively small size; as well as in its general contour, and absolute size. The two skulls also agree in the presence of two cavities in the outer surface of the maxilla, one of which (*a*) may conveniently be termed the anterior, and the other (*b*) the posterior maxillary cavity. There is, however, a very great difference in the shape and position of the former cavity in the two skulls. In *H. gracile* the posterior, or so-called larmial, cavity is very large, extending backwards as far as the anterior border of the lachrymal, or within less than an inch from the anterior border of the orbit, and having a long diameter of more than three inches. The infra-orbital foramen (*trous sous-orbitaire*) is described by Prof. Gaudry[3] as "*situé, soit a la partie antérieure du larmier, soit en dehors et un peu en avant.*" In the Perim skull, on the other hand, the corresponding cavity (*b*) is comparatively small, and separated by a considerable interval from the anterior border of the lachrymal (*la*), and by a space of two-and-a-half inches from the orbit, its longer diameter being about one-and-a-half inches. The infra-orbital foramen commences at the hinder extremity of the posterior cavity; the latter having merely the appearance of a much dilated aperture of the foramen. The same cavity extends some distance on to the outer surface of the nasal. In advance of the posterior cavity there is a broad, shallow, groove on the surface of the maxilla, conducting to the anterior maxillary cavity (*a*), which is a deep spherical depression immediately in advance of pm. 2. The corresponding cavity[4] in *H. gracile* is considerably longer and shallower; but was apparently connected with the posterior cavity by a similar groove, which the crushed condition of the Pikermi skull has to a great extent obliterated. According to Prof. Gaudry[5] distinct traces of this anterior cavity may be seen in the skulls of *E. burchelli* and

1 Seeing that if the broken maxillæ of the existing species of African horses were mingled together it would probably be quite impossible to refer them to more than one species, it is highly probable that the teeth and maxillæ referred to *H. antilopinum* really belong to more than one closely allied species. In the absence, however, of any certain points of specific distinction, the only course at present is to refer them provisionally to the same species, or group, if the latter term be preferred.

2 Gaudry, "Ann. Foss. et Géol. de l'Attique," pl. XXXV.: by the courtesy of Prof. Gaudry the writer has been enabled to compare the Perim skull with a cast of the Pikermi specimen.

3 *Op. cit.*, p. 222.

4 Marked *d* in Prof. Gaudry's figure.

5 *Op. cit.*, p. 222.

E. quagga; and they may also be detected in some skulls of *E. caballus*, where the groove occurring in advance of the infra-orbital foramen not unfrequently terminates above pm. 2 in a very shallow, but distinct depression.

The smooth form of these cavities in the Perim skull leaves little or no doubt that they once contained a sebaceous gland, like the 'larmier' of the deer and antelopes. In all deer and in most antelopes the larmier is single, and placed almost entirely in the lachrymal; having of course no connection with the infra-orbital foramen. In some antelopes, however (e.g., *Cephalopus maxwelli*, and *C. pygmæa*)[1] a similar cavity is present in the maxilla, which sometimes coexists with the lachrymal cavity, and sometimes replaces it. "In the African water-hogs [*Potamochærus*] a naso-maxillary pit opens between the eye and snout, rather nearer the eye."[2] In *Oreodon*[3] there is a single cavity which is confined to the lachrymal.

These observations indicate pretty clearly that the maxillary cavities of *Hippotherium* are homologous with those of the Artiodactyla; and are very noteworthy as being one of the very few evidences among the later forms of an original connection between the artiodactyle and perissodactyle modifications of the Ungulata.

The differences in the form of the posterior maxillary cavity in *H. antilopinum*, and *H. gracile* are so great as to leave no question of the specific distinctness of those forms, of which, from the study of the remains then available, some doubt was entertained in the second volume. The diminished size and more advanced position of the same cavity in *H. antilopinum* indicates that this species should be regarded as a form between the European species, and the modern horses; of which the African species retain most traces of their connection with the hippotheres. If the writer's memory serves him correctly, the posterior larmial cavity in the young maxilla of *H. theobaldi* from the Punjab, briefly mentioned in the second volume,[4] is of much larger size, and placed considerably nearer to the orbit than in the Perim skull.

The latter does not appear to differ in any other important points from the European species.

Distribution.—The specimen under consideration extends the range of the species to Perim Island; of which there was only some doubtful evidence at the time of publication of the second volume.

Species: *non. det.* (*? nov.*)

Upper molars.—In the accompanying woodcut (fig. 4) there are represented three associated right upper cheek-teeth of a species of *Hippotherium* lately obtained

1 See Owen, "Anatomy of Vertebrates," vol. III., p. 633.

2 Owen, *op. cit.*, p. 634.

3 Gaudry, "Les Enchainements—Mam. Tert.," fig. 90, p. 81.

4 Page 83. The specimen is No. C. 153, Indian Museum; and the present writer would be obliged to any officer of the G. S. I. who would compare it with the figure of the Perim skull, and communicate the result to the "Records."

by Mr. F. Fedden from the Siwaliks of Perim Island. The crowns of the molars were so encrusted with matrix that it was found impossible to cleanse them, and the specimen has accordingly been ground and polished. The structure of the teeth shows that they undoubtedly belong to a *Hippotherium*; and from the two first teeth being larger than the third, and less fully protruded, it is evident that the former are the two last premolars, and the latter the first true molar.

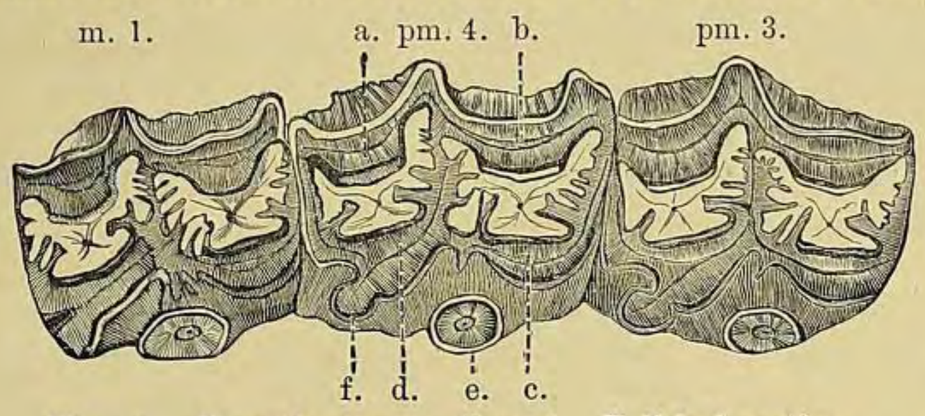

Fig 4. *Hippotherium* sp. (*? nov.*). Polished section of three right upper cheek-teeth, in a fragment of the maxilla; from the Siwaliks of Perim Island, Gulf of Cambay: Indian Museum (No. C. 273).

In the following table the dimensions of these three teeth are compared with those of the corresponding teeth of *H. theobaldi* figured in the second volume,[1] *viz.*:—

	H. theobaldi.	Specimen.
Length of three teeth	3·3	3·03
,, ,, pm. 3	1·24	1·06
Width ,, ,, ,, ...	1·12	1·0
Length ,, ,, 4	1·13	1·05
Width ,, ,, ,, ...	1·15	1·01
Length ,, m. 1	1·0	0·94
Width ,, ,, ,, ...	1·05	0·95

The united length of the corresponding teeth of the Perim skull of *H. antilopinum* described above is 2·23 inches; and the present specimen is, therefore, nearer in point of size to *H. theobaldi*. Compared with the slightly worn teeth of that species represented in vol. II., pl. XI., fig. 3, the present teeth differ by the section of the anterior pillar (*e*) being sub-circular, instead of markedly ellipsoidal, this character being most marked in the premolars: but agree in having the posterior pillar (*f*) connected with the adjacent inner crescent (*d*) by a constricted neck: the shape of this pillar differs, however, considerably, being elongated in *H. theobaldi* and rounded in the present specimen. In more worn teeth of *H. theobaldi*[1] this pillar becomes almost completely merged with the first inner crescent (*c*); which would apparently never be the case with the present teeth.

In *H. antilopinum*[2] (as in *H. gracile*) the posterior pillar of the upper cheek-teeth is always well developed, and never shows a constricted junction with the adjacent crescent, except in a very early stage of wear: the anterior pillar has much the same shape and position as in the specimen under consideration. In none of the known examples of *H. antilopinum*[3] does the length of pm. 3 exceed its width by so much as in the present specimen. Finally, the teeth of the latter are considerably larger than those of *H. antilopinum*. In the detached tooth represented in plate III., fig. 4, of this volume, which exhibits all the characters of *H. antilopinum*, the line of section is taken at precisely the same level as in the specimen under consideration; and as

1 Vol. II., pl. XIII., fig. 1.

2 Vol. II., pl. XI., fig. 1: 'F.A.S.,' pl. LXXXII., figs. 13, 16, 18: and pl. III., fig. 3, of the present volume.

3 See table on page 12.

the two specimens are from the same side of the jaw, they are excellently adapted for exhibiting the characteristic differences.

As the result of the foregoing comparisons, the present writer (although fully aware of the difficulty of distinguishing the horses solely by means of their dentition) is very strongly of opinion that the teeth under consideration indicate a third Siwalik *Hippotherium*, intermediate in size between the other two species. It was shown in the second volume[1] that a lower jaw from the Punjab provisionally referred to *H. theobaldi* differed in some respects from the type specimen, and it is possible that it may belong to the same form as the upper molars from Perim.

The latter are distinguished from the upper teeth of *H. gracile* in much the same respects as from those of *H. antilopinum*. It appears, moreover, that in all the Indian species the plications of the dentine and enamel are decidedly more complex than in the European species; this character being especially noticeable in well-worn teeth.[2]

The writer has been unable to identify the Perim teeth with any of the American species. They are markedly distinct from *H. calamarium*,[3] in which the hinder pillar of the upper cheek-teeth is remarkably large; and they differ from *H. speciosum*[4] by their superior size, by the more cylindrical anterior pillar, and the greater complexity of the plications of the enamel.

Specific distinctness.—If further discoveries confirm the conclusion that the Perim teeth probably belong to a new species, the name *H. feddeni* may be appropriately applied.

Affinities of the Siwalik species.—The extreme complexity of structure of the molars of the Siwalik hippotheres, coupled with the absence of pm. 1 in at least one species, points to the conclusion that none of these species were on the direct ancestral line of *Equus*.

Sub-Order: PROBOSCIDIA.

Nomenclature of the milk and premolar series.—In the first volume of this work,[5] owing to the general absence in the Proboscidia of the first deciduous cheek-tooth of the typical eutherian series, the three teeth of this series which are normally developed in the elephantine family of that sub-order were, following Dr. Falconer, respectively termed antepenultimate, penultimate, and last, or more generally, first, second, and third. Although this nomenclature is convenient for the Proboscidia when considered by themselves, it is apt to lead to confusion when treating of the other sub-orders of the Ungulata,[6] and the rest of the Mammalia; and it, therefore, seems best to adopt the nomenclature of the typical eutherian series. In this

1 Page 20, pl. XII., fig. 4.

2 Compare the specimens figured in Gaudry's "Ann. Foss. et Géol. de l'Attique," pl. XXXIV., fig. 7.

3 Cope, "Rep. U. S. Geog. Surv. W. of 100th Meridian," vol. IV., pt. II., pl. LXXV., fig. 1. This species is distinguished from the European and both the other Indian species by the want of the anterior projection of pm. 2.

4 *Ibid*, fig 3.

5 Pp. 198-201.

6 The discrepancy was not so marked when the Proboscidia were regarded as a group of equivalent value with the Ungulata.

PLATE I.

PERISSODACTYLA — *Rhinocerotidæ.*

Fig. 1. ACERATHERIUM BLANFORDI, var. MAJUS, Lyd. Part of left maxilla, containing the three true molars, in a well-worn condition; from the lower Siwaliks of Dera Búgti: Indian Museum (No. C. 268).

,, 2. ACERATHERIUM BLANFORDI, var. MAJUS, Lyd. Second left upper true molar, somewhat less worn than the corresponding tooth of the last specimen; from the lower Siwaliks of Gandoi, Búgti Hills: Indian Museum (No. C. 259).

,, 3. RHINOCEROS SIVALENSIS, Falc. and Caut., var. INTERMEDIUS, Lyd. Right upper true molar, slightly worn; from the lower Siwaliks of Sind: Indian Museum (No. C. 34). (*Vol.* II., *pl.* V., *fig.* 2.)

,, 4. RHINOCEROS SIVALENSIS, Falc. and Caut., var. GAJENSIS, Lyd. First or second right upper true molar, partly broken; from the Gáj group of Sind: Indian Museum (No. C. 36). (*Vol.* II., *pl.* V., *fig.* 7.)

,, 5. ACERATHERIUM PERIMENSE, Falc. and Caut. Second left upper true molar, well worn; from the Siwaliks of Burma: Indian Museum (No. C. 74). (*Vol.* I., *pl.* V., *fig.* 1. *R. iravadicus.*)

,, 6. ACERATHERIUM BLANFORDI, Lyd. First and second right upper milk-molars, from the lower Siwaliks of Gandoi: Indian Museum (No. C. 260).

,, 7. RHINOCEROS SIVALENSIS, Falc. and Caut. (type form). Second left upper true molar, from the Siwaliks of the Punjab: Indian Museum (No. C. 23). (*Vol.* I., *pl.* V., *fig.* 5.)

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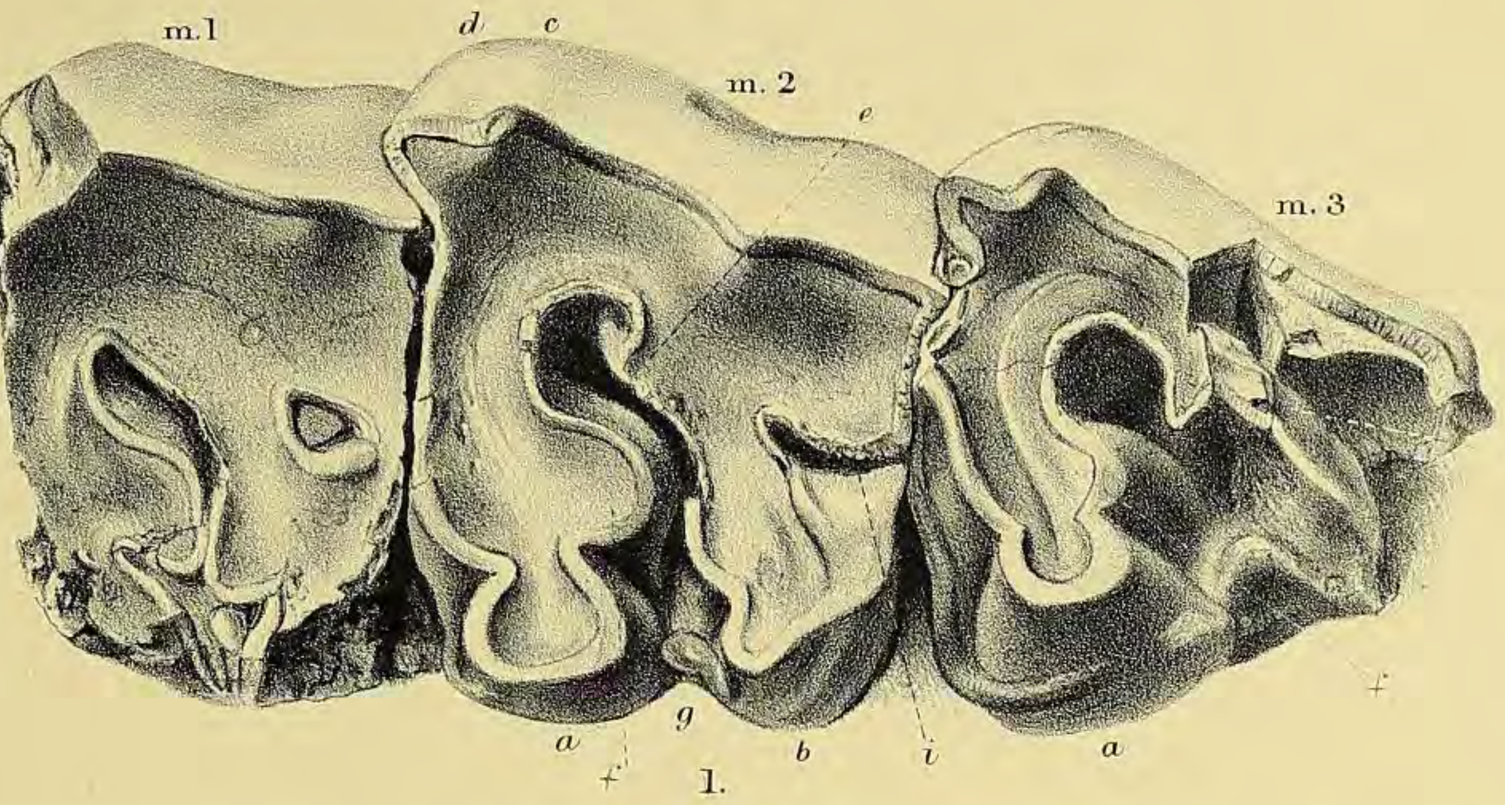
* All the figures natural size. *a*, anterior collis: *b*, posterior collis: *c*, second costa: *d*, first costa: *e*, crochet: *f*, ante-crochet: *g*, entrance of median valley: *i*, posterior valley.



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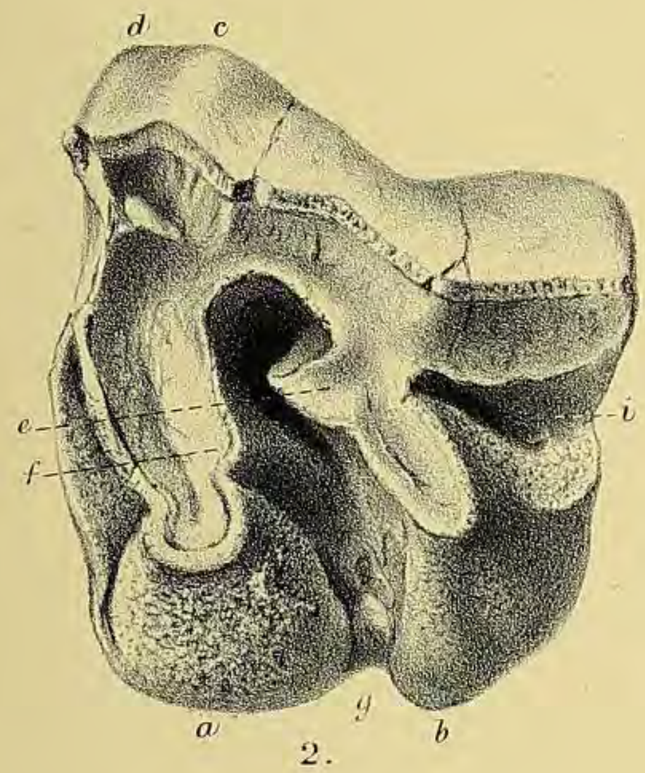

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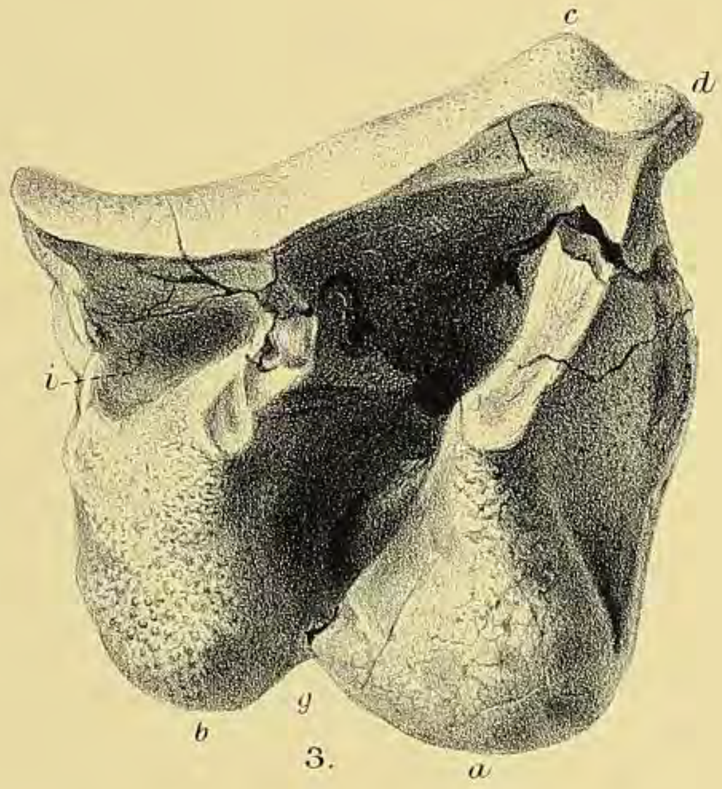

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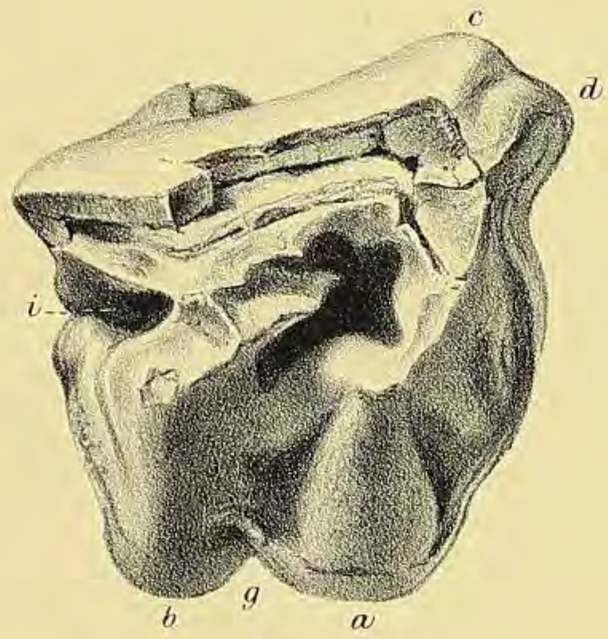

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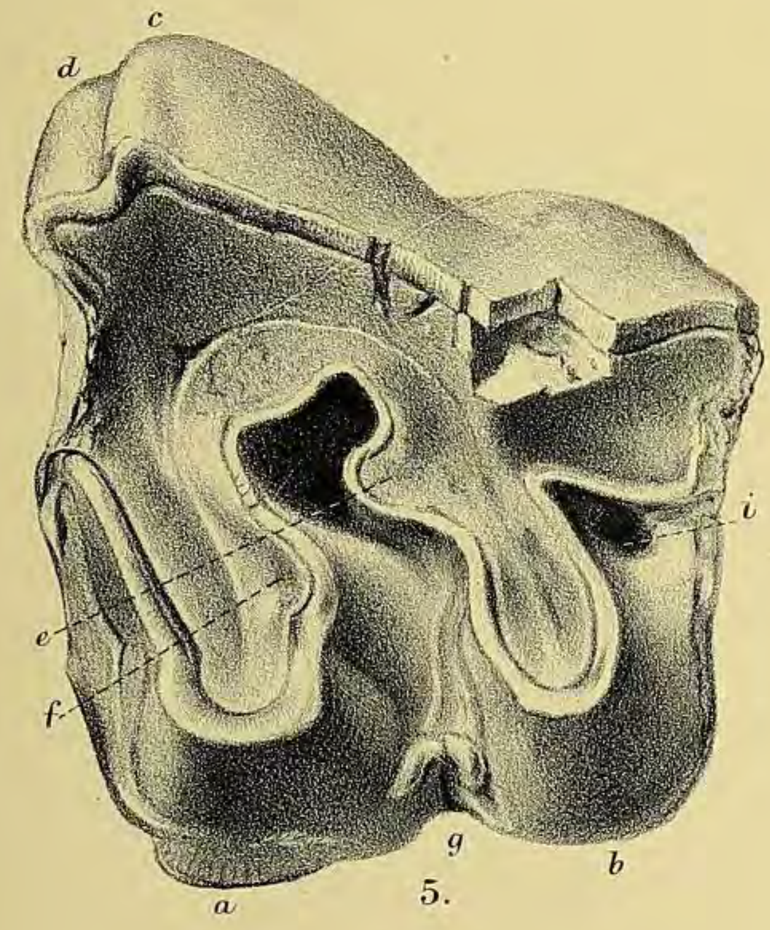

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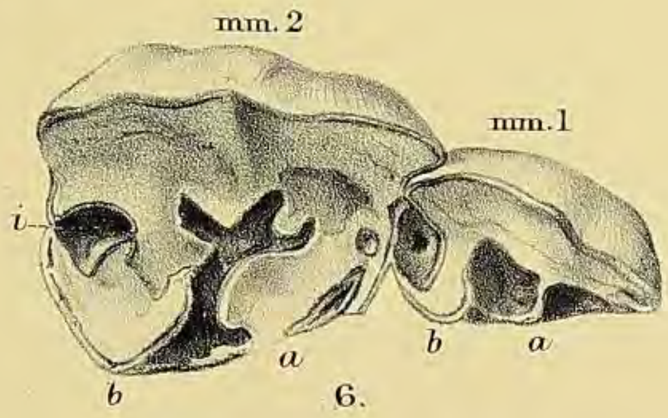

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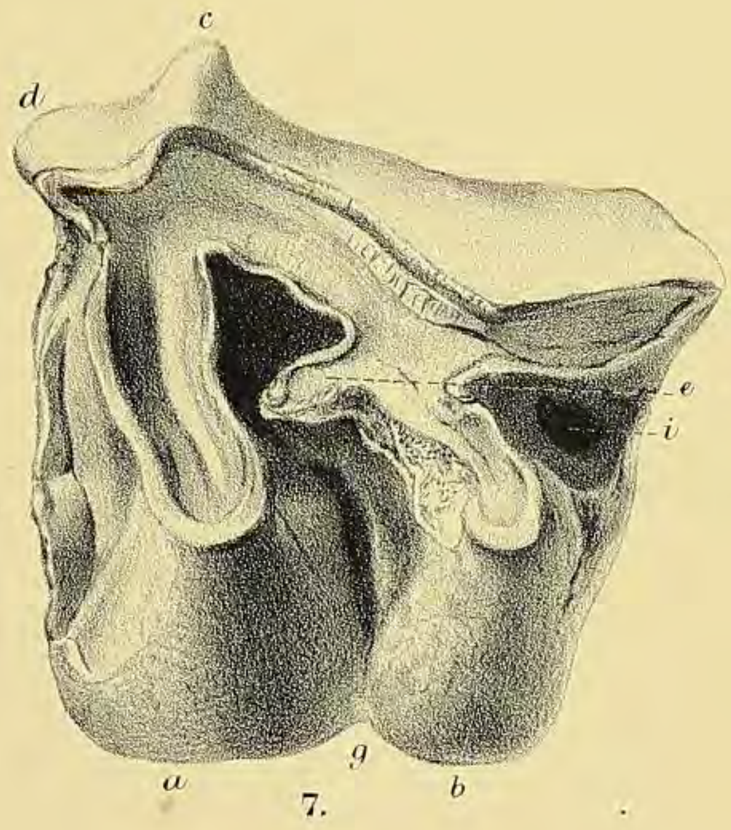

7.

J. Smit del. et lith.

Mintern Bros. imp.

PLATE II.

PERISSODACTYLA — *Rhinocerotidæ.*

Fig. 1. ? ACERATHERIUM BLANFORDI, Lyd. Last right upper milk-molar (?) in germ; Indian Museum (No. C. 258).

„ 2. ACERATHERIUM BLANFORDI, Lyd. Third right upper true molar, very much worn: Indian Museum (No. C. 262).

„ 3. ACERATHERIUM BLANFORDI, Lyd. Part of right ramus of mandible of a calf, containing one milk-molar: Indian Museum (No. C. 267).

„ 4. ACERATHERIUM BLANFORDI, var. MINUS, Lyd. Left maxilla, with the teeth in a medium condition of wear: Indian Museum (No. C. 269).

„ 5. ACERATHERIUM BLANFORDI, var. MINUS, Lyd. Part of left ramus of mandible, belonging to the same individual as the last: Indian Museum (No. C. 270).

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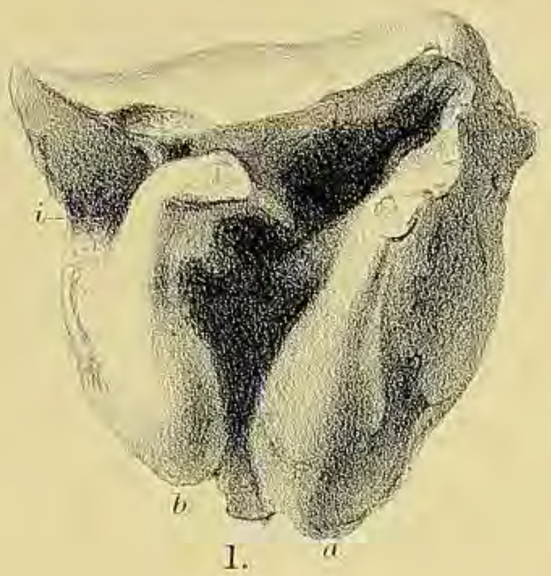
* All the specimens were obtained from the lower Siwaliks of Gandoi, Búgti Hills; and are figured of the natural size. Lettering of upper teeth the same as in plate I. In fig. 3, *a*, anterior extremity of first crescent: *b*, posterior extremity of same: *c*, posterior extremity of second crescent.



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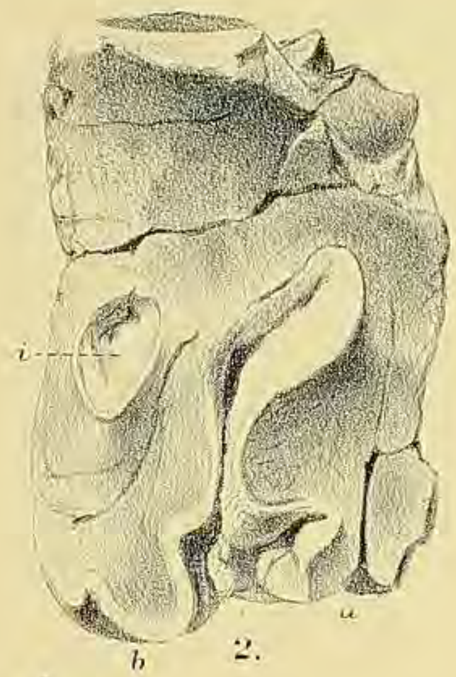

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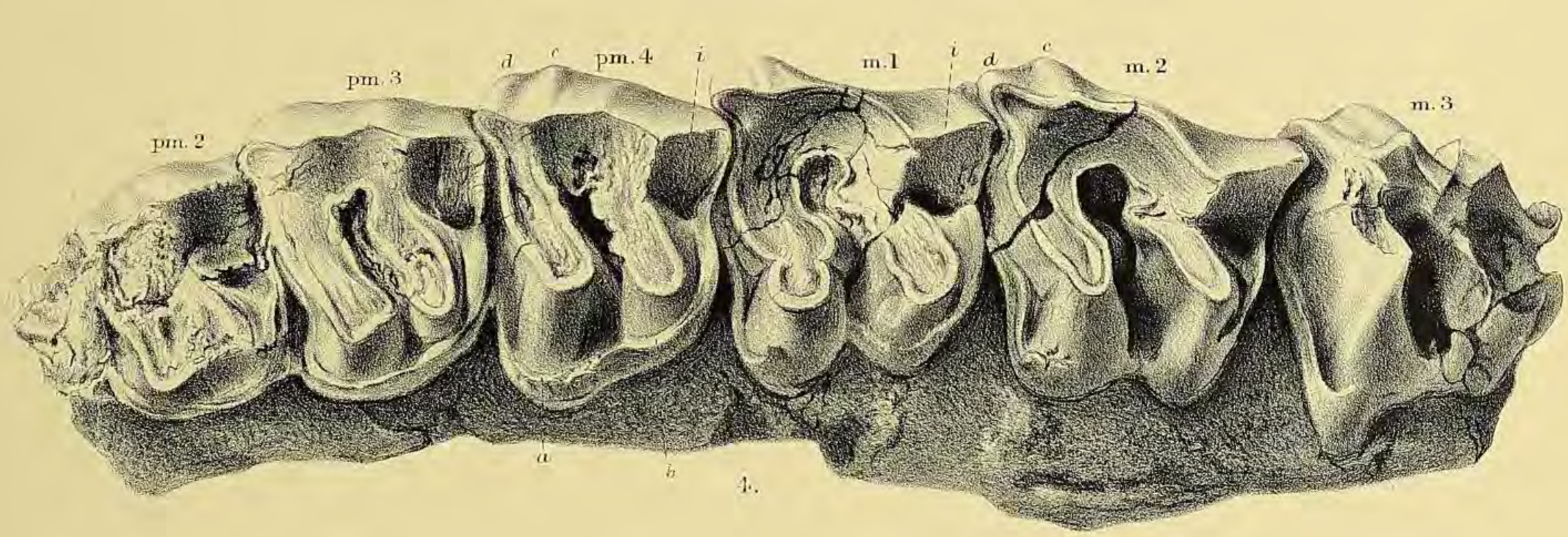

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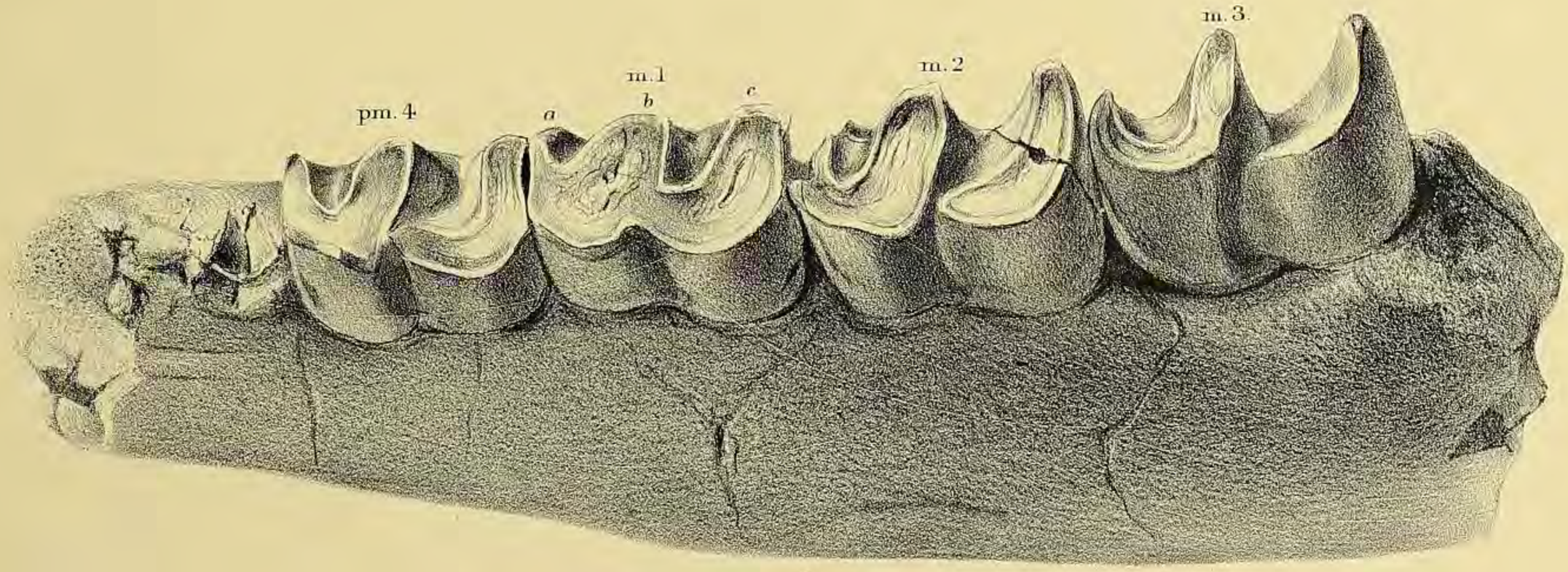

5.

PLATE III.

PERISSODACTYLA — *Equidæ*.

HIPPOTHERIUM ANTILOPINUM, Falc. and Caut.

Figs. 1, 2. Cranium, from Perim Island, Gulf of Cambay; in the possession of Mr. Theodore Cooke, of Poona. 1 from the left lateral, 2 from the palatal aspect.

,, 3. The cheek-teeth of the left side of the same specimen.

,, 4. Polished section of a tooth of the cheek-series of the right side; from the Punjab.

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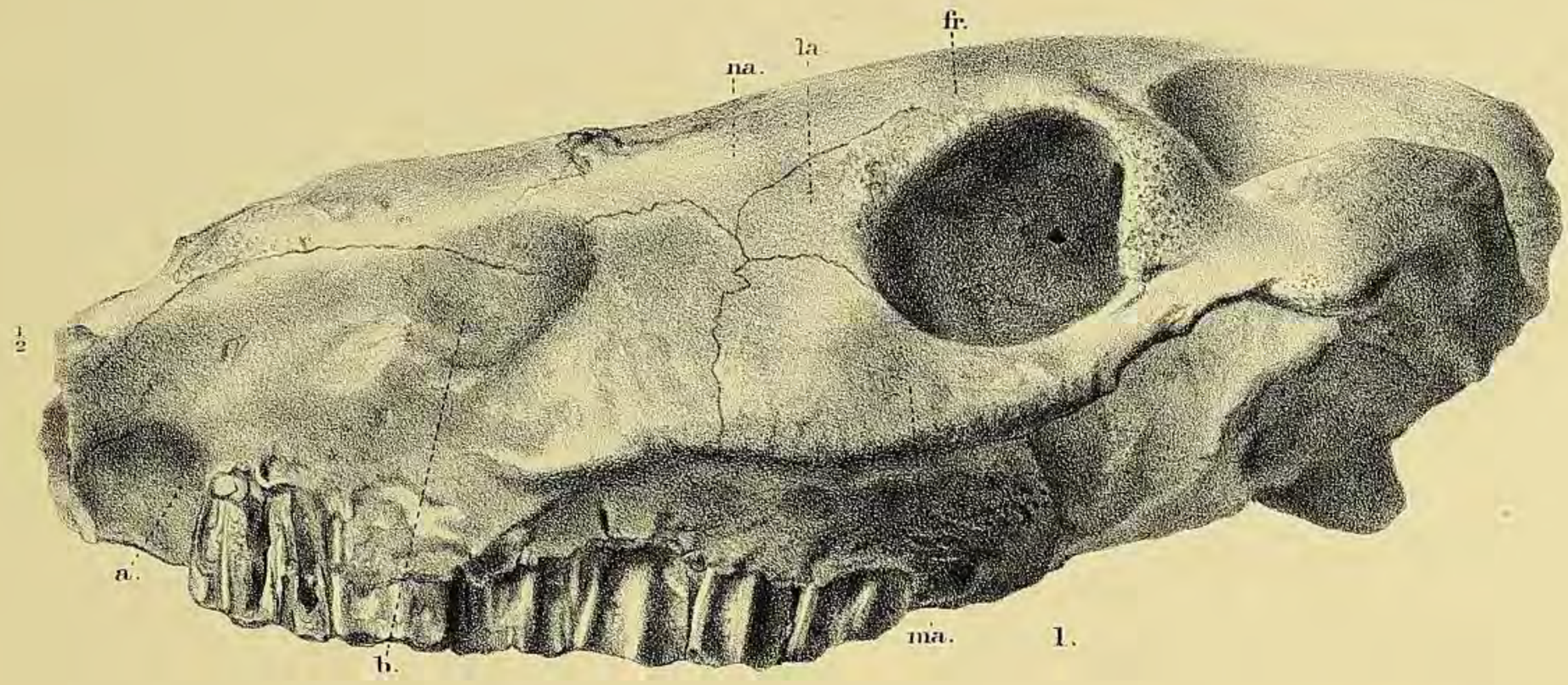
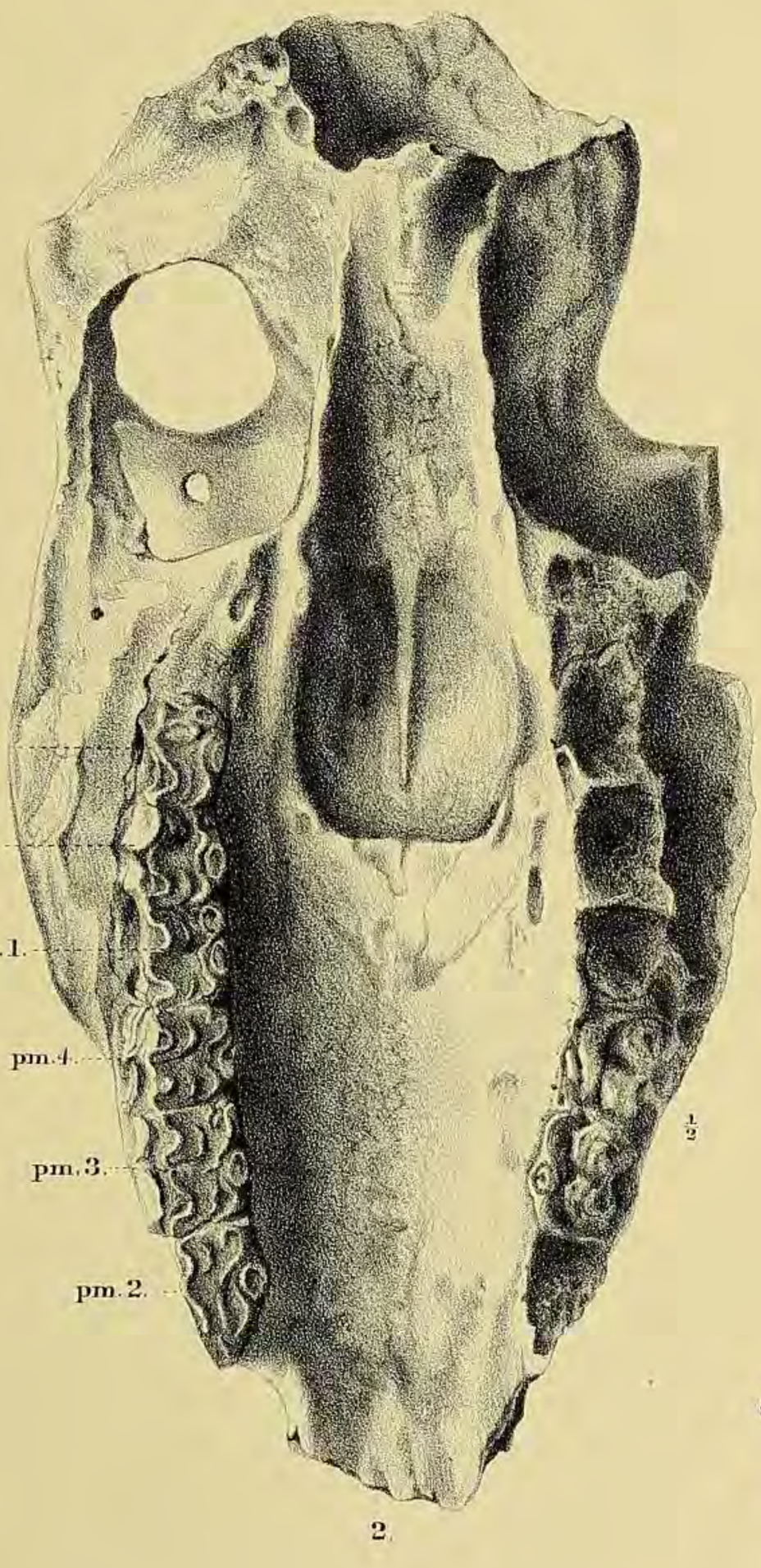
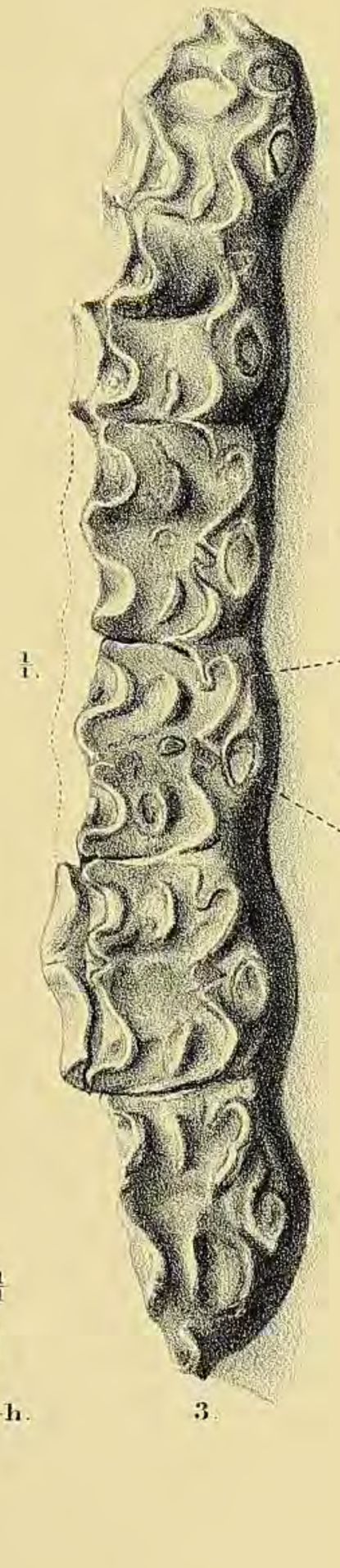
* Figs. 1, 2, one-half natural size: the others natural size: the specific determination of fig. 4 is provisional. In fig. 1, *a*, anterior maxillary cavity: *b*, posterior ditto: *na*, nasal: *la*, lachrymal: *fr*. frontal: *ma*, malar. In figs. 3, 4, *e*, anterior pillar: *f*, posterior ditto: *g*, lamina connecting first crescents: *h*, lamina connecting second ditto: *i*, *j*, cement islets.


fr.
la.
na.
½
a.
b.
ma.

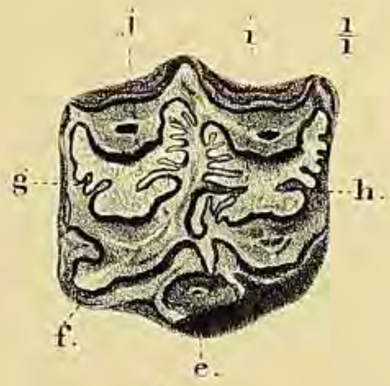
1.


m.3.
m.2.
m.1.
pm.4.
pm.3.
pm.2.
½

2.


m.3.
m.2.
m.1
1/1.
f
pm.4.
e
pm.3.
pm.2.

3.


j
i
1/1
g
h
f.
e.

4.