3. On some Cranial and Dental Characters of the existing Species of Rhinoceroses. By William Henry Flower, F.R.S., V.P.Z.S.

[Received May 15, 1876.]

While engaged lately in cataloguing the osteological specimens of the genus *Rhinoceros* in the Museum of the Royal College of Surgeons, and at the same time, through the kindness of Dr. Günther, examining those at the British Museum (the two collections comprising a total number of fifty-four skulls), several points in relation to the distinctive characters of the different species came under my notice, which I think may be worth bringing before the Society.

The principal distinguishing characters in the skeleton, dentition, and even the folds of the skin, of three distinct forms of Asiatic rhinoceroses were clearly and concisely pointed out by Cuvier in the third volume of the last edition of the 'Ossemens Fossiles' (1834). De Blainville *, Duvernoy †, and Blyth ‡ have also added to our knowledge of the same three forms, which in fact appeared to be well established as the only ones existing in that region of the world. The late Dr. Gray, however, with far more abundant material at his disposal than either of the above-named zoologists, came to very different conclusions from them, both as to the number, distinctive characters, and relations of the various species of the group §; and it is partly with the view of ascertaining how far his views can be accepted that the observations about to be recorded have been made. It is the more necessary that this should be done without further delay, as Dr. Gray's arrangement of the species has already been adopted in zoological and palæontological literature ‖.

As is well known, the existing Asiatic Rhinoceroses are sharply differentiated from those of Africa by the presence, throughout life, of well-developed and functional incisor teeth. The Museum of the College of Surgeons contains eighteen skulls of rhinoceroses of the former group of various ages, most of them, unfortunately, without locality. The British Museum contains twenty, making a total of thirty-eight Asiatic skulls, upon which the following observations are based.

The whole of these, in my opinion, can be grouped into three

* Ostéographie des mammifères. Tome iii. "Rhinocéros" (1846).

† "Nouvelles études sur les Rhinocéros fossiles," Arch. du Mus. t. iii. 1854–55.

‡ "A Memoir on the living Asiatic Species of Rhinoceros," J. Asiat. Soc. Bengal, xxxi. 1862, p. 151.

§ "Observations on the preserved Specimens and Skeletons of the *Rhinocerotidæ* in the collection of the British Museum and Royal College of Surgeons, including the Descriptions of three new Species," P. Z. S. 1867, p. 1003: mostly reprinted, with the illustrations, in the 'Catalogue of the Carnivorous, Pachydermatous and Edentate Mammals in the British Museum,' 1869.

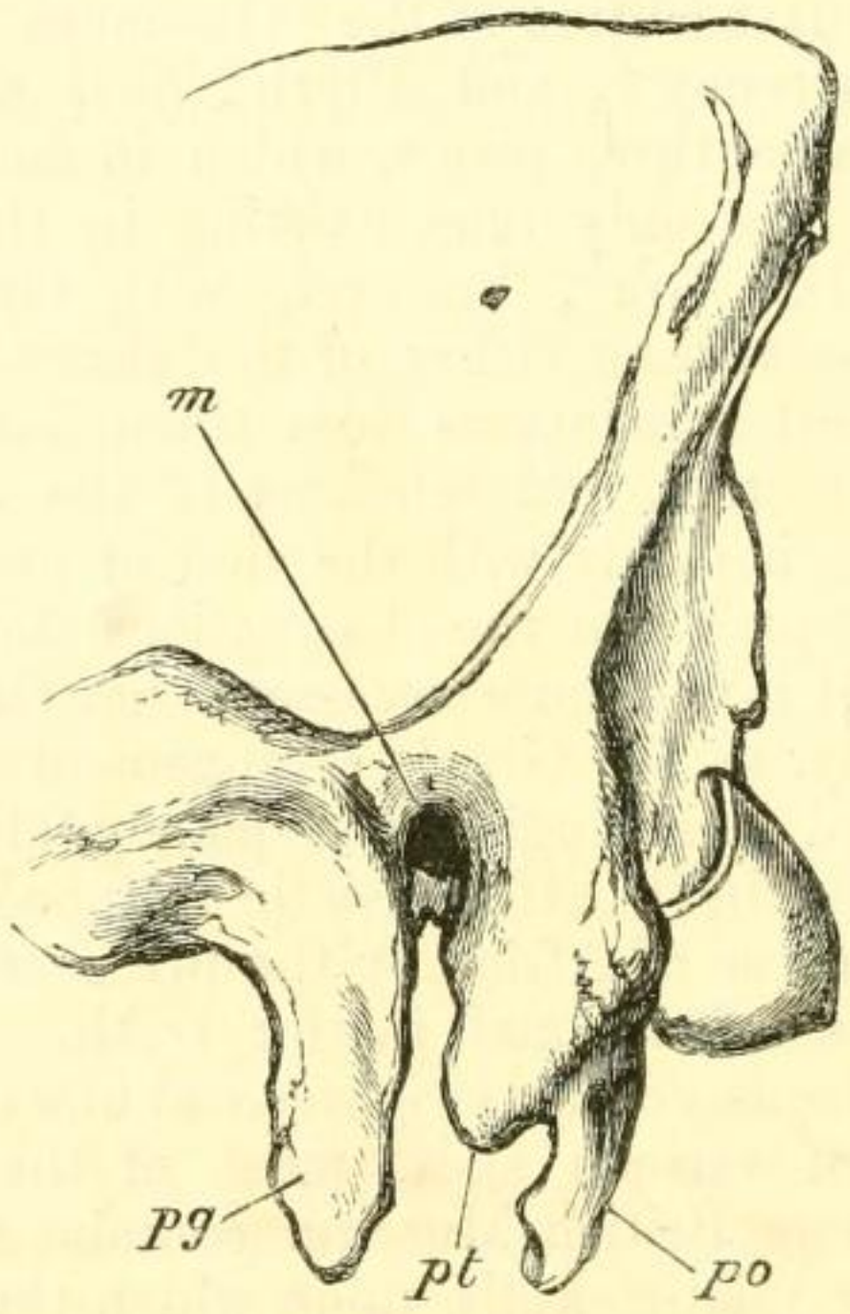
‖ See R. B. Foote, *Rhinoceros deccanensis*, 'Palæontologica Indica,' 1874.

distinct types, and no more, these three exactly coinciding with those described by Cuvier. Whether more species exist of which we have as yet received no specimens, or whether any of these types, as I have called them, represent several species separated by characters, external or anatomical, not available at present, I cannot say, especially in the prevailing uncertainty of the use of the word "species." I only mean to imply that there is nothing that I can distinguish in the materials at hand to justify their further separation.

These three are (arranged according to size) :—1. *R. unicornis*, Linn., = *R. indicus*, Cuv. (R. A. 1817); 2. *R. sondaicus*, Cuv. (in Desmarest, Mamm. 1822), = *R. javanicus*, F. Cuv. & Geoff. (Mamm., 1824); 3. *R. sumatrensis*, Cuv. (R. A. 1817). The skulls of these three species can be distinguished from one another at a glance, at any age.

Leaving out numerous minor characters, for which I must refer to

Fig. 1.



Side view of posterior part of skull of *Rhinoceros sumatrensis*. One fourth natural size.

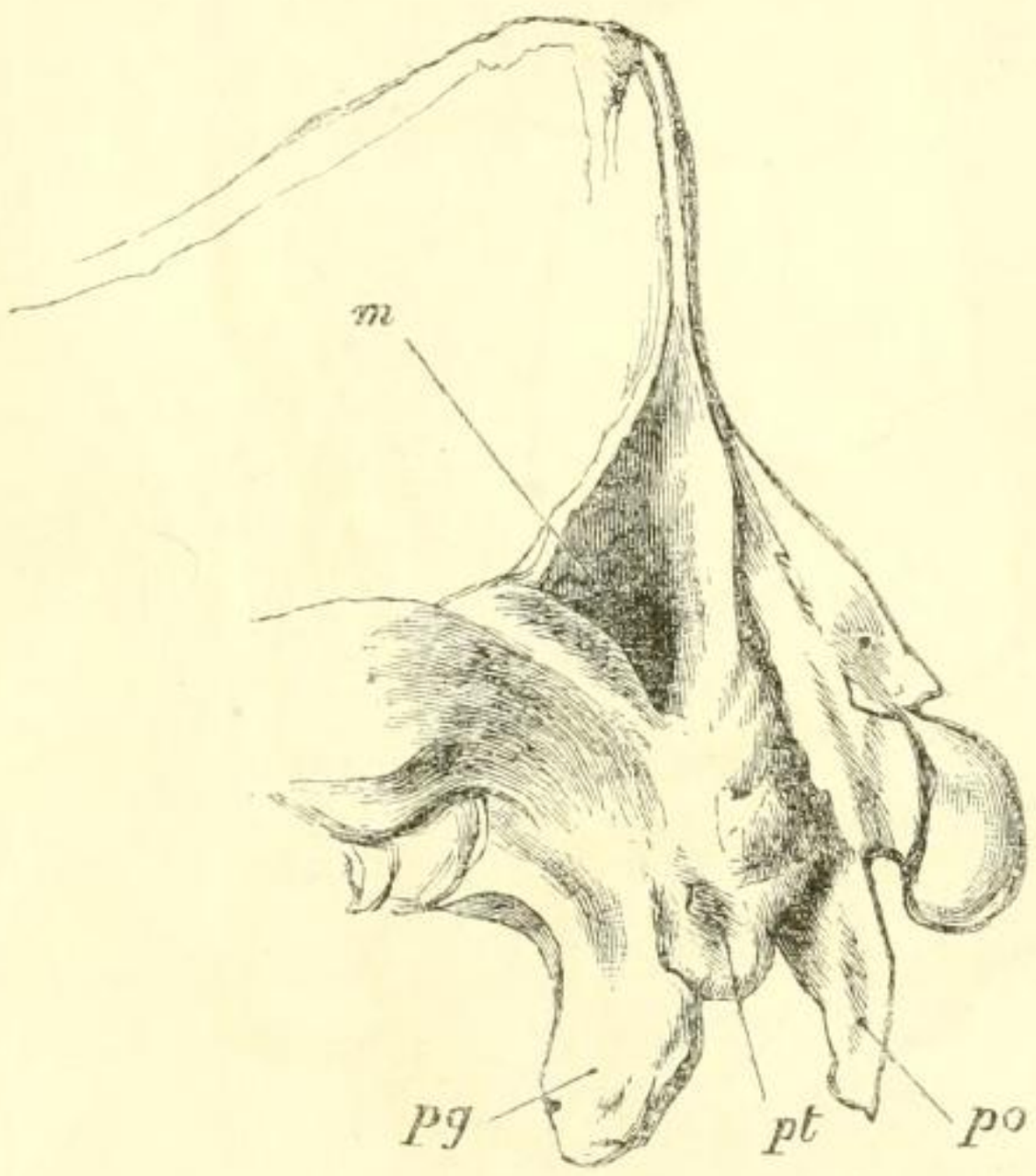
m, External auditory meatus; *pg*, postglenoid process of the squamosal; *pt*, posttympanic process of the squamosal; *po*, paroccipital process of the exoccipital.

[All the figures are from specimens in the Museum of the Royal College of Surgeons.]

the works previously mentioned, the skull of the last (*R. sumatrensis*) is separated from either of the others by a most readily recognized peculiarity in the structure of the squamosal bone, which I believe has not been generally observed. I should, perhaps, rather say that the peculiarity exists in the former two species, and that *R. sumatrensis*

conforms to the normal mammalian type, seen in *Palæotherium*, *Tapirus*, *Equus*, &c. It is that the post-glenoid and post-tympanic processes of the squamosal (fig. 1, *pg* and *pt*) do not unite below the meatus auditorius (*m*), and that the latter is, as far as the squamosal bone is concerned, a groove and not a canal, and the floor of the meatus is formed solely by the tympanic; whereas, in both existing one-horned species (fig. 2) these processes (even in the newborn animal) are in contact for a considerable space, and in old animals are ankylosed together, so that the squamosal completely surrounds the meatus as in elephant. The African rhinoceroses conform with the Sumatran in this respect, though the groove is not so wide; so that this conformation of the squamosal may be said to characterize all the existing two-horned species.

Fig. 2.



Side view of posterior part of skull of *Rhinoceros sondaicus*. One fourth natural size.

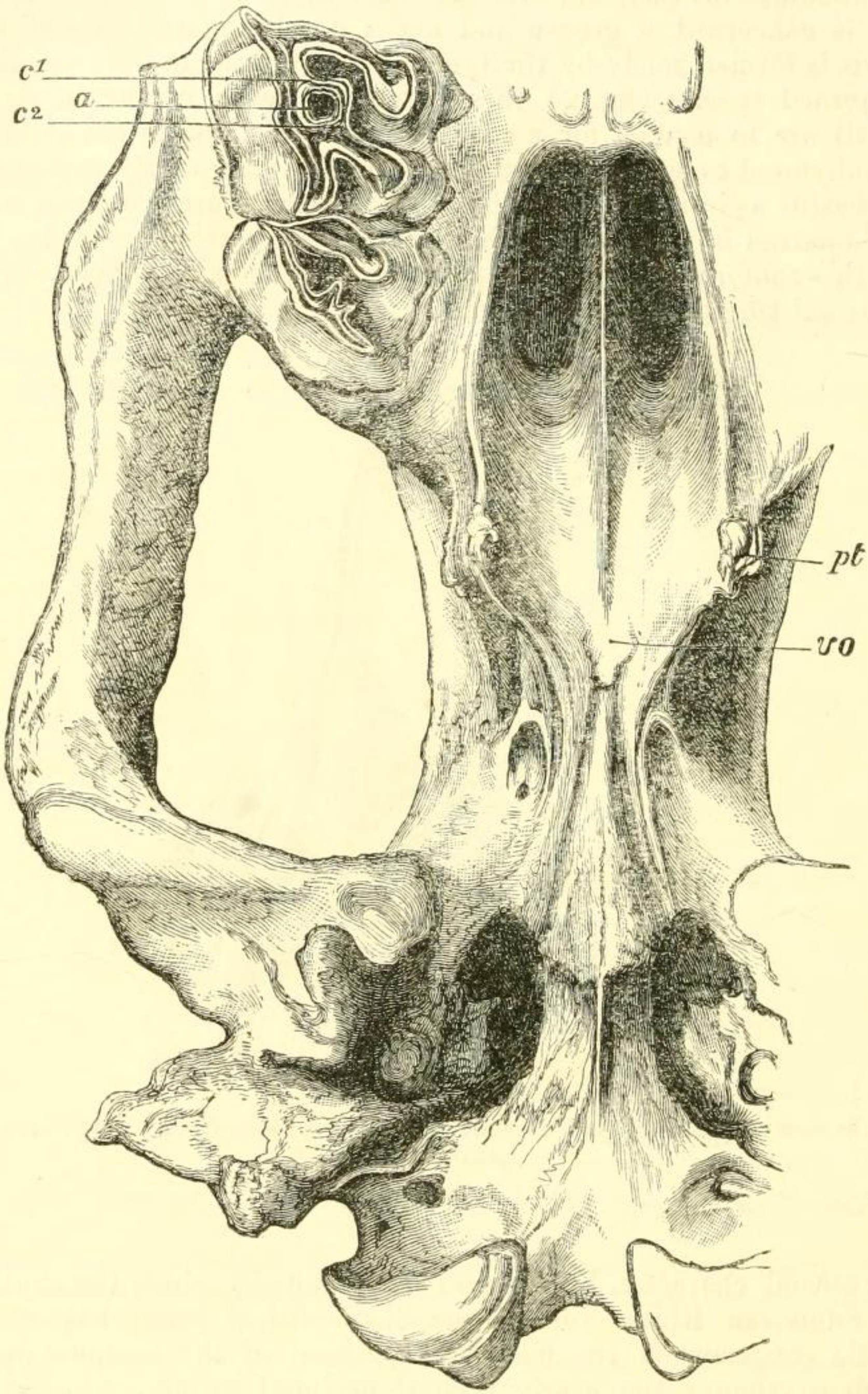
The letters as in fig. 1.

A second character, but far less important, by which the skull of the Sumatran Rhinoceros can be distinguished from that of its Asiatic congeners is the backward position of the occipital crest, which overhangs the nearly vertical occipital surface, whereas in the others the latter slopes forwards and upwards from the condyles to the crest (see figs. 1 and 2).

The slight prominence for the second horn, situated rather anterior to the centre of the conjoined frontal bones, is another diagnostic character.

It is interesting to note that in all these characters, as well as in

Fig. 3.

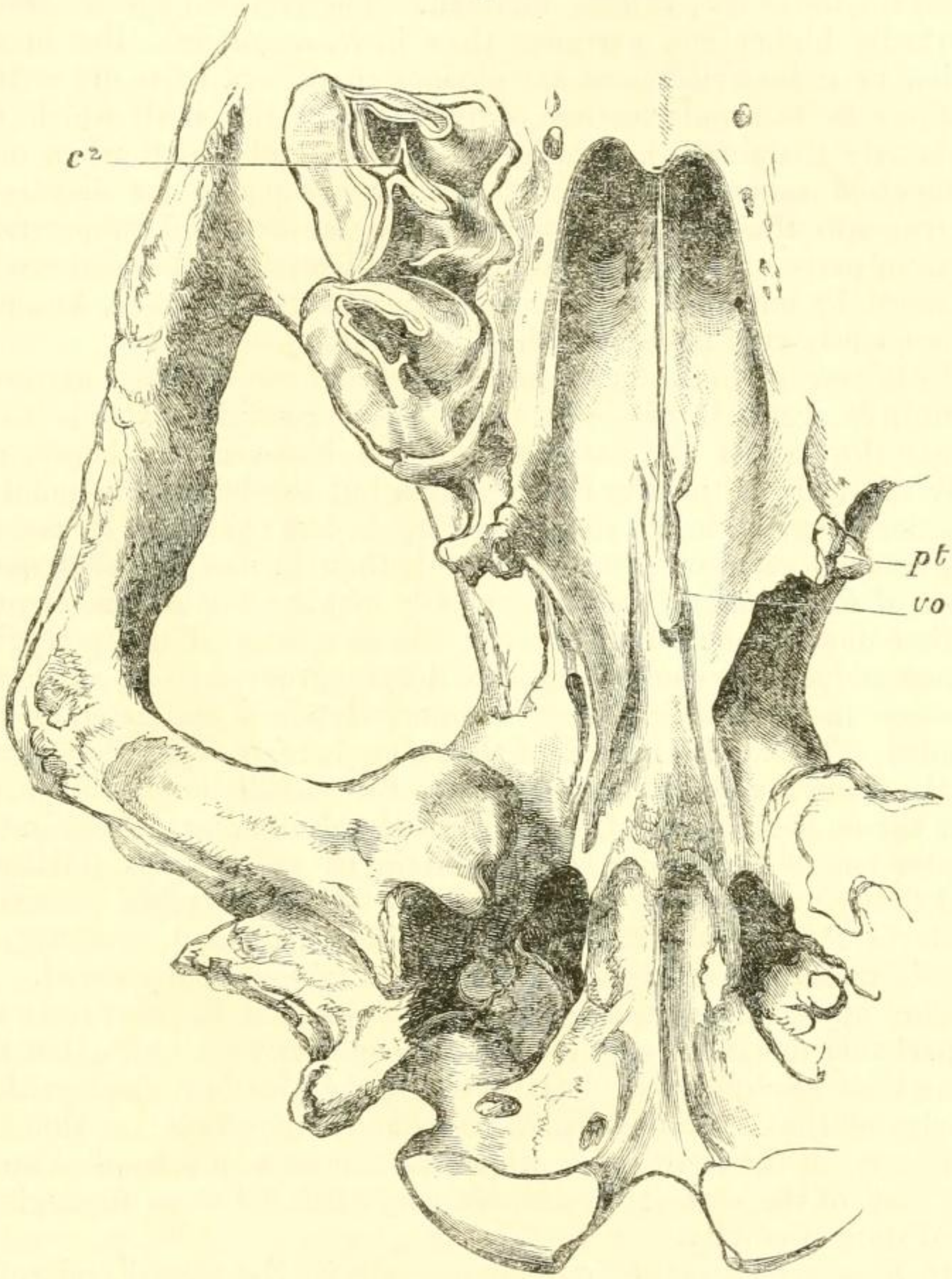


Under surface of hinder part of the skull of *Rhinoceros unicornis*. One third natural size.

pt, pterygoid processes; *vo*, hinder end of vomer; c^1, crista or anterior combing-plate; c^2, crochet or posterior combing-plate; *a*, accessory valley.

the smaller size of the incisor teeth *, this species occupies a somewhat intermediate position between the one-horned Asiatic and the African species.

Fig. 4.



Under surface of hinder part of the skull of *Rhinoceros sondaicus*. One third natural size.

pt, pterygoid processes; *vo*, hinder end of vomer; c^2, crochet or posterior combing-plate.

R. unicornis and *R. sondaicus*, being otherwise more nearly allied must be separated by less decisive, though by no means less constant and scarcely less recognizable characters.

* And, it may be added, the tendency to the loss of the lateral and the constant absence of the central lower incisors, which are present in all the specimens of *R. unicornis* and *R. sondaicus* examined, with the exception of one aged individual of the latter.

In the former, besides the greater general size and greater length and height of the cranium as compared with breadth, the ascending ramus of the mandible is considerably higher in proportion (a character much relied on by Blyth), so that the whole skull, when mounted upon the lower jaw, is more elevated. The occipital surface also is markedly higher and narrower than in *R. sondaicus*. But in addition to these well-known and obvious characters, there are certain features in the conformation of the base of the skull which are eminently characteristic of the two species, and which when once recognized cannot be mistaken, and are superior for diagnostic purposes to those derived from the general form and proportions, or from parts of the skull the form and dimensions of which are influenced by muscular development, the size of the horns, &c., and consequently very liable to individual variation.

In *R. unicornis* (fig. 3) the mesopterypoid fossa is always narrower than in *R. sondaicus* (fig. 4); and the same condition extends backwards throughout the basi-sphenoid and basi-occipital bones, not only relatively to the size of the skull, but absolutely, the point of junction between these two bones being, in large skulls of *R. unicornis*, actually narrower from side to side than in much smaller specimens of *R. sondaicus*, though generally making a more salient projection downwards. Furthermore, the free ends of the pterygoid processes (*pt*) are compressed and deeply grooved in *R. unicornis*, whereas in *R. sondaicus* they are more flattened and laterally expanded. The hinder margin of the palate is more regularly concave in the former, and has a projection in the middle line in the latter. But the most absolutely diagnostic structural difference is seen in the hinder end of the vomer (*vo*), which in *R. unicornis* is thickened and firmly united by its sides to the base of the pterygoid processes, while in *R. sondaicus* it is thin, lamelliform, pointed, and free, so that in museum specimens it is very often injured or destroyed.

The upper molar teeth of *R. unicornis* and *R. sondaicus* are remarkably unlike for species otherwise so nearly related*; but the same kind of difference exists between the two best-distinguished species of the African forms, *R. simus* and *R. bicornis*; so that the characters of the teeth alone, which have been so much relied on in the case of the extinct species, are not, when taken by themselves, good tests of affinity.

In *R. unicornis*, in the first and generally in the second molar, the *crochet* (or posterior combing-plate) (c^2) curves forwards and usually unites with the *crista* (anterior combing-plate) (c^1) developed from the lamina, so as to cut off an "accessory valley" (*a*) from the extremity of the median sinus†. The premolars and milk-molars present a

* Professor Owen says truly in his 'Odontography,' p. 594 (1845):—"Even in existing species so nearly allied as the unicorn Rhinoceroses of India and Java, each might be determined by a single detached molar tooth." But his views must have been subsequently modified; for in the descriptive catalogue of the Museum of the College (1853), the skulls of both species are described under the common name of *R. indicus*.

† For an explanation of these terms see Busk, P. Z. S. 1869, p. 410, "Notice

similar conformation, subject to individual variation. This never takes place in the true molars of *R. sondaicus* (though it may occasionally in some of the milk-molars, especially the second), as in fact the crista is rarely developed in that species, and the crochet is a simple straight free process in the true molars, though often double in the premolars.

On the other hand the molar teeth of *R. sondaicus* and *R. sumatrensis* are remarkably alike. Mr. Busk, it is true, has pointed out characters by which they can be distinguished *; but they are such as to require great attention on the part of the observer to detect, and one of them, the difference in the relative length and breadth, does not appear to me to bear the test of application to a considerable series of individuals. I may, however, add another, which appears to be tolerably constant, viz. the greater depth of the posterior as compared with the median sinus in *R. sumatrensis*, whence it results that in an extremely worn tooth of the latter there are always two fossæ, the median and posterior, while in *R. sondaicus* the posterior disappears, leaving finally only a single fossa in the wide surface of exposed dentine. In *R. unicornis*, in a corresponding stage of attrition, there are three *fossæ*—the median, accessory, and posterior.

The premolars of *R. sumatrensis* can be distinguished from those of *R. sondaicus* by the complete absence of the double crochet above mentioned as usually, if not always, present in the latter.

It is a curious circumstance that the remains of *R. sondaicus*, though more recently distinguished as a distinct species, are more abundant in our collections than those of *R. unicornis*. In the College-of-Surgeons Museum there are 9 skulls of this species, and 5 of *R. unicornis*. In the British Museum the numbers are respectively 9 and 7. This may be accounted for by the geographical range of the species, as it is *R. sondaicus* which inhabits the Bengal Sunderbunds, and the neighbourhood of Calcutta, while *R. unicornis* is only known from the hilly country to the north, bordering upon Nepal, Bhotan, and Assam. On the other hand, judging from the figures, nearly all the living examples of rhinoceroses brought to this country before the present specimen of *R. sondaicus*, which was acquired by the Society in 1874, have belonged to the species which we call *R. unicornis*; but this is a subject which has been discussed in Mr. Sclater's article on the species of *Rhinoceros* living in the Society's Gardens, shortly to be published in our 'Transactions' with magnificent illustrations of external characters of five species drawn from life.

To return to the collection of skulls. Judged by the tests above given, and by other characters more difficult to describe, but easily appreciated on an examination of the specimens, the one described

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of the Discovery at Sarawak, in Borneo, of the fossilized Teeth of Rhinoceros." In one of the specimens of *R. unicornis* in the British Museum, though the crochet and crista are well developed, there is no actual union of their extremities.

* *Loc. cit.*

and figured by Dr. Gray in the paper above referred to as *R. floweri*, and called in the Catalogue of the Museum of the College of Surgeons *R. sumatranus*, is a very characteristic specimen of *R. sondaicus*, belonging perhaps to what Blyth would call the narrow type of that species. It was presented by Sir Stamford Raffles together with the Sumatran specimens, though no locality is recorded for this individual. This circumstance probably occasioned its being entered in the Catalogue as *R. sumatranus*; for although it is not certain that it came from Sumatra, it is quite probable, as we have now other reasons for believing that *R. sondaicus* is an inhabitant of that great island. The two skulls in the British Museum (supposed to be from Borneo) described by Dr. Gray as *R. nasalis* also present, in my opinion, no characters by which they can be distinguished from *R. sondaicus*, while on the other hand his *R. stenocephalus* is a young example of *R. unicornis*, or at all events has all the essential characters of that species as distinguished from *R. sondaicus*. The specific distinctions relied upon by Dr. Gray, the narrowness and rounding of the upper surface of the skull, appear to me far too liable to individual variation to constitute valid characters without other evidence *.

A skeleton, lately received at the British Museum, through Mr. Franks, of Amsterdam, from Sumatra, is *R. sondaicus*, thus affording confirmatory evidence to that already obtained † of the presence of both the two-horned and one-horned species in that island.

A still more interesting circumstance, as enlarging our knowledge of the geographical distribution of these animals, is, that the young skull obtained from Borneo by Mr. Low, of Labuan, added last year to the British-Museum collection, and of the habitat of which there is not a shadow of uncertainty, as in the case of the other supposed Bornean skulls in the same collection (which are *R. sondaicus*), belongs to the two-horned species or *R. sumatrensis*. This fact, with that lately recorded by Mr. Sclater ‡, of the occurrence of this form in Assam, give the two extremes at present known of its range.

A question has lately arisen whether there may not be two species of Asiatic two-horned rhinoceroses. Cuvier already believed that there were two varieties in the island of Sumatra, distinguished by their size; but the question has been brought into prominence by the presence in our gardens of two living animals of the same sex, one from Chittagong, and one from the southern part of the Malay peninsula, presenting such differences of size, colour, length of tail, and distribution of hair, that they would strike any zoologist as being examples, if not of different species, at least of very well marked varieties. In the former light they have been regarded by Mr. Sclater, who has bestowed the name of *R. lasiotis*, or Hairy-eared

* Mr. Busk (P. Z. S. 1869, p. 413, foot-note) has already recorded his opinion that all these three species of Dr. Gray are indistinguishable from *R. sondaicus*. As regards the first two, as will be seen above, I am of the same opinion, but not as regards the third.

† The teeth brought by Mr. Wallace and described by Mr. Busk, and the probability of the skull presented to the College of Surgeons by Sir T. Raffles being from that island.

‡ P. Z. S. 1875, p. 566.

Rhinoceros, on the larger and lighter-coloured individual, retaining the name of *R. sumatrensis* for the smaller one, of which we have recently received a second example.

This determination has been called in question by Dr. Gray; and there are certainly some difficulties in deciding which of the two is the original *R. sumatrensis* of Cuvier (R. A. 1817), founded on Bell's description and figure in the 'Philosophical Transactions' for 1793, as that animal, if correctly drawn, must have been in some respects intermediate between our two living forms. On the whole, however, I am most inclined to think that the small and dark species (Dr. Gray's *Ceratorhinus niger*) is the nearest to Bell's Sumatran Rhinoceros, which is the view taken by Mr. Sclater. There is a skull in the Museum of the College of Surgeons (No. 2936), presented by Sir Joseph Banks, which is stated in the first edition of the Osteological Catalogue (1831) to have been the original of that figured by Bell in the 'Philosophical Transactions.' If this could be proved to be the case, it would satisfactorily determine the cranial characters of the true *R. sumatrensis*; but the discrepancies between the figure and the skull are so great * that, with every allowance for inaccuracy on the artist's part, it is impossible to believe that they could be intended for the same; and, indeed, the author of the second Catalogue (1853) appears to have come to this conclusion, as the reference to the Phil. Trans. is omitted in the description of the specimen. It is, however, extremely probable that the skull in question may have been sent to Sir J. Banks by Bell, as the latter had more than one specimen and was in communication with Sir Joseph, who presented his memoir to the Royal Society; and therefore it may fairly be regarded as a representative of the same species.

As long as the type of Sclater's *R. lasiotis* lives, the important question as to whether any osteological or dental characters are connected with the differences of external appearance cannot be determined; and as my present purpose is only with such characters, I must leave it out of consideration, and return to the eight skulls, four in the College of Surgeons, and four in the British Museum, that are available for examination.

Of those in the first-named collection, three are probably from Sumatra, having been presented by Sir Stamford Raffles; and the other is the one just mentioned, given by Sir Joseph Banks, probably also from Sumatra.

Of those in the British Museum, the locality of one is not recorded; one is from Pegu, having been purchased from Mr. Theobald; one is from Borneo, as previously mentioned; and the last is from the small dark-coloured animal, from Malacca, which died in the Society's Gardens in 1872, an aged female †. This differs from all the others in having no lower incisor teeth. Unless, as is probable, this is an

* Chiefly as regards age, as shown by the teeth, and not differences of any specific value.

† See Mr. Garrod's notes on its anatomy, P. Z. S. 1873, p. 92, where the remarkable difference between the structure of the mucous membrane of the intestine and that of *R. unicornis* is described. It is interesting to note

individual peculiarity due to age, it is an important character. A specimen in the Brussels Museum is in an exactly similar condition.

On comparing these skulls, can any character be found to indicate that they belong to more than one species? Of seven of them I have little hesitation in saying that the differences of proportion and general configuration which occur among them may well be considered within the limits of individual variation; but of one, that from Pegu, in the British Museum, No. 1461 *a*, I am doubtful. There are differences in the conformation of the base of the skull, and in the greater length and more compressed form of the post-glenoid process, which separate it from the others; but without further evidence of correlated differences in other parts of the organization, or without further specimens showing the same characters, I should not feel justified in considering these differences specific, knowing that the development of processes for the attachment of muscles are among the most variable of characters. I merely indicate them to direct the attention of any one who may have an opportunity of examining the skull of *R. lasiotis*, or of any fresh examples brought to this country, to compare them with this specimen, especially as Pegu is the most northern locality (and therefore nearest to Chittagong) of any of the skulls of this form of Rhinoceros. The three Sumatran specimens from Sir Stamford Raffles all differ somewhat in size and form; but, allowing for age, the Malacca specimen at the British Museum (*R. niger*, Gray) does not appear to differ materially from them.

Of African rhinoceroses, the British Museum possesses a fine series of eleven skulls, and the College of Surgeons five.

The two distinct types, exemplified by *R. simus*, Burchell, and *R. bicornis*, Linn., are recognizable at a glance. The larger size of the former, together with the depressed, spatulated form of the front end of the mandible, distinguish it at once. It is worthy of note that though the front of the jaws, especially the mandible, of the latter, are so much more reduced and narrow, the incisor teeth are better developed and more persistent. In a young *R. bicornis*, from Abyssinia, in which all the milk-molars are in place and worn, there are rudimentary incisors ($\frac{1}{1}$) in both jaws *; but in two specimens of *R. simus* of younger age, in which the milk-molars are quite unworn, and the last still concealed in its alveolus, there is no trace of incisors; so that, as far as this character is concerned, *R. simus* is

that precisely the same circumstance was recorded, though very briefly, in a description of the viscera of a rhinoceros sent from Sumatra by Sir S. Raffles, of which Sir E. Home says (Philosophical Transactions, 1821, part i. p. 271), "the small intestines measured fifty-four feet six inches; the valvulæ conniventes are continued nearly through the whole extent, and in general circular, although not all so."

* In a specimen in the Museum of the College of Surgeons, figured in Owen's 'Odontography,' there are two incisors on each side in the mandible; and these sometimes persist to adult age, as shown by Dr. Gray, P. Z. S. 1869, p. 225. This distinction between *R. simus* and *R. bicornis* was also noticed by Duvernoy in the young specimens in the Paris Museum.

the most specialized of all the living Rhinoceroses. The broad form of the front of the lower jaw, as compared with *R. bicornis*, is quite well seen in these very young specimens.

With regard to the molar teeth, the same kind of difference occurs between these forms as between the two Indian one-horned species. The larger one has a greater complexity of arrangement, derived from the more frequent union of crochet and crista, cutting off an accessory valley. But it must be noticed that there is an extraordinary variation in this respect between two examples of *R. simus* of nearly the same age in the British Museum, so great, indeed, that, if supported by other characters, they might be taken to indicate specific distinctness. In fact they either do this or show that the precise pattern of the enamel-folds of the molar teeth, so much relied upon by palæontologists to distinguish species, is a rather uncertain character. In one of these skulls (No. 1003*a*) the crochet and crista are united in all the premolar and molar teeth of both sides. In the other (No. 1003 *b*), an older specimen, and somewhat smaller, though presenting all the general characters of the species, they are united only in the left second premolar, in both third premolars, in both first molars and in the right third molar. The want of symmetry throws some doubt upon the value of this character*; otherwise it might, combined with the smaller size and narrower nasals of this specimen (perhaps only sexual differences?), lend some countenance to the common belief among African sportsmen and travellers, that there is a second large species allied to *R. simus*.

In the smaller African rhinoceros, *R. bicornis*, the crochet and crista of the molar teeth are both well developed, but rarely united in the true molars, though frequently so in the premolars. Whether there is one or more species of this form, has long been debated by zoologists; but those who have given their verdict for two have founded their decision solely on external characters, chiefly the form and size of the posterior horn, and no attempt has ever been made to show whether any osteological or dental characters were correlated with these. In fact, until very recently there were no materials accessible for the investigation. The acquisition by the British Museum of two complete skeletons of the reputed *R. keitloa*, and others of *R. bicornis*, with the horns attached, has, however, rendered the investigation a practicable one. I have not yet had the leisure to make the careful examination of the whole skeleton which would be desirable; but, comparing the skulls and teeth of perfectly adult individuals presenting both varieties of horns, I have not been able to detect any differences either of size, general proportions, or relations of the various bones to each other, that could reasonably be called specific. All that can be inferred from this is, that I have not at present seen any thing derived from osteological or dental structures to confirm the belief in the existence of more than one species of the smaller type of African rhinoceros. Other observers may, with more ample materials, be more fortunate; and I

* And its variability as before noted, in specimens of undoubted *R. unicornis*.

am by no means disposed to underrate the testimony of many experienced field-naturalists on this subject. Such osteological evidence as we have upon the question, if applied to the genus *Equus*, would probably fail to distinguish the three well-recognized South-African species of Zebras.

The results derived from the examination of these fifty-four skulls of *Rhinoceros* may be thus tabulated:—

A. The adults with a single large compressed incisor above on each side, and occasionally a small lateral one; below, a very small median, and a very large, procumbent, pointed lateral incisor. The post-glenoid and post-tympanic processes of the squamosal united below the external meatus auditorius. The posterior occipital surface sloping from below upwards and forwards, the crest being anterior in position to the condyles. Nasal bones pointed in front. A single nasal horn. Skin very thick, raised into strong, definitely arranged ridges or folds. RHINOCEROS, Linn.

a. Larger size. Upper molar teeth with crochet and crista generally united, cutting off an "accessory" valley from the median sinus. Posterior end of vomer thickened and adherent. Mesopterygoid fossa and basi-occipital narrow. Hinder margin of palate regularly concave. Occipital surface high and narrow. Ramus of mandible high.

1. R. UNICORNIS, Linn.*

R. indicus, Cuv. (R. A. 1817).
R. stenocephalus, Gray (P. Z. S. 1867).

b. Smaller size. Upper molar teeth without crista. Posterior end of vomer thin and free. Mesopterygoid fossa and basi-occipital broad. Hinder margin of the palate produced in the middle. Occipital surface broad and low. Ramus of mandible low †.

2. R. SONDAICUS, Cuv. (in Desm. Mamm. 1822).

R. javanicus, F. Cuv. & Geoffr. (Mammifères, 1824).
R. floweri, Gray (P. Z. S. 1867).
R. nasalis, Gray (P. Z. S. 1867).

B. The adults with a single moderate-sized compressed incisor above, and a single, laterally placed, pointed, procumbent incisor below, which is sometimes lost in old animals. The post-glenoid and post-tympanic processes of the squamosal not meeting below the meatus auditorius. Occipital crest produced backwards so as to

* Cuvier's names for this and the common African species are often preferred on the following grounds:—"The names of *R. unicornis* and *bicornis*, Linn., can be no longer retained, since more than one species is known, both of those with one and of those with two horns" (Van der Hoeven's Handbook of Zoology). But as a precisely similar objection can be raised against the names *indicus* and *africanus*, nothing is gained by the change.

† The differences in external appearance, and especially in the skin-folds, between *R. unicornis* and *R. sondaicus* are well seen in the figure published in the Society's 'Proceedings,' 1874, pl. xxviii.; also in two sketches in 'Nature,' April 9th, 1874, from the animals living in the Society's menagerie.

overhang the occipital surface of the skull. Nasal bones narrow and pointed anteriorly. A well-developed nasal and a small frontal horn separated by an interval. The skin thrown into folds, but not so strongly marked as in A. CERATORHINUS, Gray, P. Z. S. (1867) *.

1. C. SUMATRENSIS, Cuv. (R. A. 1817).

C. sumatranus, Raffles (Trans. Linn. Soc. vol. xiii. 1822, p. 268).
C. niger, Gray (Hand-list Edentates &c. Brit. Mus. p. 48, 1873).

2. C. LASIOTIS, Sclater (P. Z. S. 1872, p. 493).

(Anatomical characters unknown.)

C. In the adults the incisors are either quite rudimentary or entirely wanting. The post-tympanic and post-glenoid processes not united below the auditory meatus. Occipital crest produced backwards, and overhanging the occipital surface of the skull and condyles. Nasal bones thickened and rounded or truncated in front. An anterior and posterior horn in close contact. Skin without any definite permanent folds. ATELODUS, Pomel (1853) †.

a. Smaller size. Incisor teeth always present in the young, and sometimes persistent as rudiments through life. Molar teeth with crista and crochet rarely united. Front end of mandible deep and compressed.

1. A. BICORNIS, Linn.

R. africanus, Cuv. (R. A. 1817).
R. keitloa, A. Smith (Cat. S. A. Mus. p. 7, 1837).

* These terms may be taken either as generic, or as indicating natural sections of the Linnean genus *Rhinoceros*. The great differences in the visceral anatomy (referred to above) between this species and the first, tend to support the former view. Their significance will, however, be better understood, when the internal anatomy of the third section is known, and also that of *R. sondaicus*.

† Pomel divided the genus *Rhinoceros*, Linn., into three subgenera :—

1. *Acerotherium*, Kaup.
2. *Rhinoceros*, Linn.
3. *Atelodus*, Pomel.

The last is thus defined. "Os nasaux portant une ou deux cornes ; pied à trois doigts. Une ou deux paires d'incisives inférieures caduques en forme de simple tubercule souvent à peine sorti de la gencive, ou nulles ; pas de plis à la peau sur les espèces vivantes."

The following are the species assigned to this group :—

A. elatus (Croizet & Jobert)	extinct.
A. leptorhinus (Cuv.)	
A. tichorhinus (Cuv.)	
A. aymardi (Pomel)	
A. bicornis (L.)	existing.
A. keitloa (A. Smith)	
A. simus (Burchell)	

("Catalogue méthodique et descriptif des vertèbres fossiles découverts dans le bassin hydrographique supérieur de la Loire," Part ii., in 'Annales scientifiques, littéraires et industrielles de l'Auvergne,' tom. xxvi. 1853, p. 114.)

b. Larger size. Incisor teeth, if ever present, disappearing very soon after birth. Molar teeth with crista and crochet generally united. Front end of mandible depressed and spatulate.

2. A. SIMUS, Burchell (Bull. Soc. Philomat. p. 96, 1817).

A. oswellii, Gray (P. Z. S. 1853, p. 46).

In reference to the name of this group, *Cœlodonta* (Bronn, Jahrbuch für Mineralogie, 1831, p. 51) was proposed for some teeth supposed to belong to a new genus allied to Rhinoceros, but subsequently identified as those of the well-known *R. tichorhinus*, Cuv.* It can scarcely be retained, however, for the group now under consideration, as its definition would include *R. unicornis*, and exclude many of the species without incisor teeth. It was, in fact, never equivalent to Pomel's *Atelodus*, though it might be used (as by Dr. Gray, *loc. cit.* 1867) by any one who thinks fit to separate *R. tichorhinus* generically from all the other members of the family. In the Catalogue of the bones of Mammalia in the British Museum (1862), Dr. Gray uses *Rhinaster* for all the species of existing African rhinoceroses; but in the memoir so often referred to above (1867) this name is limited to *R. bicornis* and *R. keitloa*, and *Ceratotherium* is introduced for *R. simus*. *Rhinaster*, as applied to the Rhinocerotidæ, appears to be later than *Atelodus*. It was, moreover, proposed by Wagler (Syst. Amphib. 1830) as a substitute for Illiger's genus *Condylura* (Insectivora), on account of the latter being inappropriate; but it has not been generally adopted. As the termination of such a term as *Ceratotherium*, by common consent of zoologists, has hitherto been restricted to extinct genera, its application to *R. simus* is inconvenient. Fortunately, in the grouping proposed above, the name is unnecessary, as the members of the family with the incisor teeth small or absent form a well-characterized, even if somewhat artificial, generic group, which scarcely needs further subdivision.

Although most of the known extinct species of *Rhinoceros* may be arranged under one or the other of the above sections, the definitions would have, as, indeed, might be expected, to be considerably modified to include them. Thus *R. schleiermacheri*, Kaup, of the late European Miocenes, though allied to *R. sumatrensis* in possessing incisor teeth and two horns, and so far coming under the definition of *Ceratorhinus*, retains the central lower incisors of *Rhinoceros* proper, and has the post-glenoid and post-tympanic processes united, as, indeed, have all the extinct forms that I have examined. On the supposition that this species is the direct ancestor or representative of the *Ceratorhinus* group of modern times, the presence of the four inferior incisors, as a more generalized character, is quite natural; but the structure of the squamosal is not so easy to understand, as being more specialized than in the modern species. Precisely the same occurs with the former representatives of the *Atelodus* group, of

* *R. antiquitatis*, Blum., is the earliest name for this species, and is adopted by Brandt and Dr. Falconer, though Cuvier's name still holds its ground with most authors.

which the Miocene *R. pachygnathus*, Wagner, from Pikermi, is the earliest known form, and the four extinct British species, *R. etruscus*, Falc., *R. leptorhinus*, Cuv., *R. hemitœchus*, Falc., and *R. tichorhinus*, Cuv., are more or less modified members. The recently discovered *R. deccanensis*, Foote, from South India, appears to belong to it also. The several species found in the Siwalik beds and other parts of South Asia appear to have belonged to the genus *Rhinoceros* as restricted above, with large incisors and one horn.

To include all the extinct members of the family at present known; the genus *Aceratherium*, Kaup, must be added for the species with no horn, large incisors, and four toes on the fore feet, *Diceratherium*, Marsh, for species with indications of a pair of lateral horns on the nasals, and *Hyracodon*, Leidy, for primitive forms without horns and retaining the complete number of forty-four incisor, canine, and molar teeth, the latter of comparatively simple structure without crochet or crista. When we extend our search for Rhinocerotidæ beyond the Miocene period, we find that they cease to be recognizable as such, and become merged into more generalized perissodactyle forms.

4. Further Notes on *Oulodon*, a new Genus of Ziphioid Whales from the New-Zealand Seas.

By Julius von Haast, Ph.D., F.R.S., Director of the Canterbury Museum, Christchurch, New Zealand.

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It will be seen from the following notes that the presence of a row of small teeth in the upper jaw is a constant character in my *Mesoplodon grayi* (P. Z. S. 1876, p. 7); and unless it shall be shown by future researches that other species belonging to the genus *Mesoplodon* have similar rows of small teeth and of a permanent character in the upper jaw, I think that the generic term *Oulodon* ought to be applied to the Ziphioid Whales distinguished by that peculiar feature, which, so far as I am aware, no others of the group possess.

Since I had the pleasure to lay the description of the three skulls obtained on the Chatham Islands before the Society, four specimens belonging to the same Ziphioid, which with our local fishermen goes under the name of Cowfish, have been stranded on the coast near Saltwater Creek, about 30 miles north of Banks Peninsula. One of them, a small male (A) about 13 feet long, was washed ashore on the 15th of December, 1875. On the 29th of December another male (B), 12 feet 9 inches long, was stranded, together with a female (D), 17 feet 6 inches long, on the beach a short distance north of the entrance of the Saltwater-Creek Estuary; whilst another male (C), 13 feet 8 inches long, ran the same day into that small estuary, and was left high and dry by the receding tide.