reasonable objection to the name *Rhinoceros antiquitatis*. South of the Rhine, that is in Geneva, France, and Italy, all modern palæontologists call the species *Rhinoceros tichorinus*; but, north of the Rhine, in Germany, Holland, Scandinavia, and Russia, the most eminent authorities designate it *Rhinoceros antiquitatis*. A name in science ought not to be a disputed point of mere geographical predilection. Blumenbach named it first *Rhinoceros antiquitatis*. Fischer de Waldheim, a palæontologist of no great authority, changed the name into *Rhinoceros tichorinus*, and Cuvier adopted Fischer's name without acknowledgment. Desmarest called it *Rhinoceros Pallasii*. Blumenbach's names of *Elephas primigenius* and *Mastodon Ohioticus* are now accepted by everyone; and there is no reason why his *Rhinoceros antiquitatis* should be rejected for a more modern name. Living neither north nor south of the Rhine, I have no geographical predilections, and as an impartial foreigner I accept the earliest name, viz. Blumenbach's; besides, the name *Rhinoceros tichorinus* is faulty, inasmuch as three species had a nasal septum.

I.—On Rhinoceros hemitœchus, an extinct species prevailing in the Gower Caves, South Wales.[1]

In two previous communications (Quart. Journ. Geol. Soc. for Nov. 1857, and vol. xiv. p. 81),[2] I have attempted to trace the distribution of the fossil Proboscidea, with some of their constant associates, in the newer Tertiary deposits of England, and in corresponding deposits on the continent of Europe. One important branch of the inquiry concerns the fossil remains of the ossiferous caves; but my examination of the cave-collections was not, at the time, sufficiently extended to warrant well-founded conclusions on the subject. I had seen undoubted evidence of the occurrence of *Elephas antiquus* and *Hippopotamus major*—both Pliocene forms—in several of the English caverns; but I was in doubt regarding the associated fossil species of Rhinoceros. Since then I have had opportunities of examining most of the great cave-collections in the metropolitan and provincial museums, and of investigating, on the spot, the conditions under which the remains were associated in several of the most productive caverns. Some of the results appear to be of sufficient interest to warrant my bringing them before the Society,[3] although with less detail of evidence, and in a more restricted form, than the nature of the case might seem to demand. But the general subject is so extensive in its relations as hardly to

[1] The MS. of this essay was found among Dr. Falconer's papers, and is now for the first time published.—[Ed.]

[2] See *antea*, pp. 1 and 76.—[Ed.]

[3] The paper was evidently intended for presentation to the Geological Society.—[Ed.]

be susceptible of being embraced within the scope of a single communication; and the remarks which follow the descriptive details forming the special subject of this essay will be confined to the association, in some of the ossiferous caverns in England, of the remains of certain of the fossil mammalia, which I regard as positive indicators of the age of Pliocene deposits, without reference to the altered physical conditions of the caves at different periods, or to the agencies by which the remains were introduced within them.[1]

I may premise that my inquiries have embraced an examination, more or less detailed, of collections from the following caverns:—Kent's Hole, Oreston, and other South Devonshire caves; Banwell, Bleadon, Hutton, Berrington, &c., in the Mendip Hills; Paviland, Spritsail Tor, Minchin Hole, Bacon's Hole, and Bosco's Den, in the peninsula of Gower, in South Wales; Cefn, in North Wales; Kirkdale and Wirksworth. The museums which have been visited in search of materials are the British Museum and those of the College of Surgeons and Geological Society, in the metropolis; and in the provinces, Oxford, for Dr. Buckland's very extensive and classical series of cave-remains from British and foreign localities; Bristol, for the interesting collection from Durdham Down, formed and described by Mr. Stutchbury; Taunton, for the collection amassed during many years by the Rev. D. Williams, from Bleadon, Hutton, and others of the Mendip Caverns; Torquay and Plymouth, for Kent's Hole and Oreston; Swansea, for the Gower Cave collections; and York, for that from Kirkdale. I have further had the advantage of examining the private cave-collections of the veteran Mr. Wm. Beard, at Banwell, from the Mendip caverns; of Miss Talbot, at Penrice Castle, from Paviland; and, above all, the unrivalled collection formed at Stout Hall, by my friend Colonel E. R. Wood, F.G.S., during the last nine years, from the ossiferous caves of Gower. This last has furnished more materials for the description of the extinct Rhinoceros, which is the special subject of this paper, than all the rest together.

Rhinoceros hemitœchus.[2]—The species to which I have assigned this name (for reasons which will more fully appear in the sequel) is, avowedly, not a new accession, except by name, to the Fossil Fauna of Britain. It has long been familiar to geologists as the *Rhinoceros leptorhinus* of Cuvier, according to Professor Owen, and described at great length

[1] This portion of the essay was never written; but the subject will be found treated in the author's paper, 'On the Ossiferous Caves of Gower.'—[Ed.]

[2] From ἥμισυς, half, and τοῖχος, partition, in reference to the partial nasal septum, distinctive of the species.

in the 'British Fossil Mammalia.' I have arrived at the conclusion that it is essentially distinct from the original *Rhinoc. leptorhinus* of Cuvier, which latter, however, I believe occurs in England, in beds, in some respects different from those in which *Rhinoc. hemitœchus* prevails, and to a certain extent, with different associates. In this view, the exact identification of the two species becomes in its geological bearings a question of much higher importance than the mere rectification of a specific name. Before entering on the descriptive details, it will be necessary to revert to the origin of the name *Rhinoc. leptorhinus*, and to trace the successive opinions which have been entertained by palæontologists regarding it up to the present time; for there is not, within the whole range of Mammalian Palæontology, an extinct species regarding which more has been written and more opposed views advanced.

The great French anatomist, having conclusively demonstrated the distinctness of the Siberian Rhinoceros from all the species then known, framed his diagnostic character upon the most obvious of its peculiarities, namely, the ossified nasal septum, and designated it '*le Rhinoceros à narines cloisonées*,' or *Rhinoceros tichorhinus*. His attention was naturally awakened to the probability of other species occurring in the fossil state, in which the nasal septum would be found to agree with existing species, in presenting the ordinary condition of an unossified cartilage. Cortesi had discovered in 1805, upon Monte Zago, near Piacenza, the entire skull, in fine preservation, of a fossil Rhinoceros, which he referred with doubt to a young *Rhin. bicornis*.[1] A drawing of this cranium, by M. Adolphe Brongniart, and thus carrying high authority with it of a competent execution, was many years afterwards forwarded to Cuvier from Milan. The figure represented a cranium differing essentially in form and proportions from that of the Siberian Rhinoceros, and most obviously in the absence of the bony partition of the nostrils, characteristic of the latter. Cuvier inferred that the Italian form constituted a different species, which, in contradistinction, he named '*le Rhinoceros à narines non-cloisonées*,' or *Rhinoceros leptorhinus*. The specific distinctions which he indicated for the latter were, that the cerebral part of the skull was proportionally shorter than in the Siberian form, and less projected backwards over the occiput; the position of the orbit above the fifth molar; the termination of the nasal bone by a free point having no connection with the intermaxillaries through a bony partition; and the abbrevia-

[1] Saggi Geologici, p. 72, tab. vii.

tion and different form of the intermaxillaries. To these cranial characters he added more slender proportions in the general construction of the skeleton, inferred from Val d'Arno specimens which he attributed to the same species; and he held that the Italian fossil form approached more nearly to the *Rhinoceros bicornis* of the Cape than to any other known species. He appears to have considered that it had been invested with two horns. Upon the characters of the molar teeth he furnished little beyond what was merely conjectural; for, having founded his conception of the species mainly upon the characters furnished by Cortesi's skull, without examining the molars in that specimen, he took it for granted that all the lower jaws, molars, and other remains, occurring in Italy, which did not admit of identification with *Rhinoc. tichorhinus*, must of necessity belong to his *Rhinoc. leptorhinus*. The subject was not at the time sufficiently advanced, nor the materials in sufficient abundance, to lead him to conjecture that there might have been two or more Italian fossil species different from the Siberian form. But there are now the strongest grounds to believe that such is the case; and that Cuvier, as in the similar instance of *Eleph. primigenius*, *Eleph. antiquus*, and *Eleph. meridionalis*, confounded the remains of at least two Italian fossil species of *Rhinoceros* under the common designation of *Rhinoceros leptorhinus*.

Rhinoceros leptorhinus, as thus defined by Cuvier, met with ready acceptance among palæontologists, and remained undisputed until the year 1834, when M. de Christol,[1] in a very able and elaborate memoir 'On the Characters of the Large Species of Fossil Rhinoceros,' broadly asserted that this supposed species had no existence in nature, and that Cortesi's cranium belonged to the Siberian form, *Rh. tichorhinus*. Christol, like Cuvier, had not an opportunity of examining the original, which in the interval had suffered considerable injury by fracture of the facial portion; but, having received from Milan fresh drawings of the specimen thus altered in appearance, he erroneously interpreted as a bony septum a shaded representation of the internal surface of the nasal cavity of the left side of the head, viewed from the right side, where the corresponding part was mutilated. Dr. Cornalia, of Milan, so late as 1853, submitted Cortesi's cranium to a rigid examination, specially with a view to the determination of this point, and states in the most positive terms that there is not a trace even of the supposed bony septum: 'Cette cloison n'existe nullement. La voûte de la cavité nasale ne présente, le long de sa ligne médiane, aucun prin-

[1] Annales des Scienc. Nat. 1835, 2me Sér. tom. iv. p. 44.

cipe de cloison descendante qui aurait pu être détruite. Enfin je suis sûr, et je vous assure que le crâne que nous conservons n'appartient pas au *R. tichorhinus*, et qu'on a eu tort de confondre les deux espèces. Le regard de M. Cuvier était bien plus perçant et tombait plus justement dans le vrai.' [1] Christol erased *Rh. leptorhinus* from the list of fossil species, and at the same time proposed the name of *Rhinoceros megarhinus* for the remains of a two-horned fossil species occurring in the Pliocene Sands of Montpellier, and characterized by the great length of the nasal bones; by the short interval between the nasal sinus and the orbits; by the slight elevation of the pyramid of the vertex above the plane of the brow; by the inconsiderable inclination of the occipital plane, which is abruptly truncated at the vertex; by the relative position of the orbits, and by peculiarities in the teeth. Marcel de Serres had previously endeavoured to distinguish the same form under the name of the 'Fossil Rhinoceros of Montpellier' (*Rhinoceros Monspessulanus*, De Blainv.); but gave way to the dissent expressed by Cuvier, who identified it with his '*Rhinoceros à narines cloisonées*.' Christol was further led to the conclusion that the *Rhinoceros incisivus* of Cuvier was identical with his *Rhinoc. megarhinus*.

From a remark by Laurillard, it would appear that at a later date Christol was convinced that his opinion respecting *Rhin. leptorhinus* was erroneous; but no formal expression of this altered view having been published, the objections which he had raised continued for a considerable time to influence the opinions of palæontologists.

Croizet and Jobert, in 1828, described and figured remains of a *Rhinoceros* from Puy-de-Dôme, which from its general slender proportions they designated *Rhinoceros elatus*. No perfect cranium of this form has as yet been discovered in the Velay; and the jaws and teeth at present known are not sufficiently pronounced to determine with certainty whether *Rhinoceros elatus* is distinct, or to what nominal species it ought to be referred. De Blainville identified it with the Miocene *Rhinoceros incisivus*! Laurillard doubted whether it ought to be referred to *R. megarhinus* or to *R. leptorhinus*; Pomel refers it to his *Atelodus elatus*, which includes *Rhinoc. elatus*, together with *Rhinoc. megarhinus* of Christol; and Gervais hesitatingly refers it, together with Owen's form of

[1] The first authoritative correction of Christol's statement was made in 1842, by Professor Balsamo Crivelli, the curator of the Museum of Santa Teresa in Milan, where the specimen was preserved. He states, that the supposed partition was absolutely wanting, and explains the cause of the mistake. But the correction escaped the notice of European Palæontologists until 1853, when Dr. Cornalia of Milan, at the request of Duvernoy, re-submitted the Cortesi cranium to a rigid examination.

Rhinoceros leptorhinus from Clacton, also to *Rhinoceros megarhinus*.[1]

Jäger, in 1839, proposed the provisional name of *Rhinoceros Kirchbergense* for certain remains discovered in sand-pits in the pleistocene ('Diluvial-boden') deposits of Kirchberg in Wurtemberg. The materials were limited to one lower and two detached upper molars; and the comparison of them was confined to corresponding teeth of *Aceratherium incisivum*, of the *Rhinoceros tichorhinus* occurring at Cannstadt, and of the two-horned Rhinoceros of the Cape. No attempt was made by Jäger to distinguish the Kirchberg form from the *leptorhine* Rhinoceros of Cuvier, the *R. elatus* of Croizet, or the *R. megarhinus* of Christol.[2] The name proposed by Jäger has therefore strictly no claim to be regarded otherwise than as a conjectural determination; and at a later period he abandoned it, having adopted the opinion of Owen, that the Kirchberg Rhinoceros was identical with the supposed *Rhinoceros leptorhinus*, discovered at Clacton, as described in the 'British Fossil Mammalia.'

In 1841 Kaup brought out, in the 'Akten der Urwelt,' his description of the same nominal species, but under the new designation of *Rhinoceros Merckii* of Jäger, who, at the instance of his friend Kaup, consented to the substitution of this specific name, both as less open to objection on the score of local derivation, and as a tribute to the memory of Merck, its earliest indicator, who, towards the close of the last century, made the first important step towards the distinction of the Mammoth from existing species. Kaup collected additional materials from various localities in the valley of the Rhine, and extended their comparison, beyond what was attempted by Jäger, to supposed remains of the *Rhinoceros leptorhinus* of Cuvier. The conclusions at which he arrived were, that *Rhinoceros Merckii* was a distinct species, of the size of the two-horned Rhinoceros of the Cape; that it belonged, jointly with *Rhinoceros Africanus* (*R. bicornis*) and *Rhinoceros leptorhinus* of Cuvier, to a particular division of the genus, characterized by the form of the molar teeth and the absence of incisors; and that it had been a contemporary of the Mammoth, *Rhinoceros tichorhinus*, *Rhinoceros leptorhinus*, and other forms of the so-called Diluvial Period.[3]

The next step of importance in the history of *Rhinoceros*

[1] It was subsequently referred by Dr. Falconer to *Rhin. Etruscus*.—[Ed.]

[2] The lower jaw, in the reference to fig. 6, tab. xvi., is attributed by Jäger to *Rhin. tichorhinus*.

[3] In his last work (Beiträge, 1 Heft. p. 4), Kaup gives up *Rhin. Merckii* for *Rhin. leptorhinus*.

leptorhinus dates from the publication of the 'British Fossil Mammalia' in 1846, when Professor Owen brought out his elaborate and detailed description of the remarkable cranium and other remains discovered at Clacton, in Essex, by our veteran Associate, Mr. John Brown, of Stanway. The skull in question is chiefly notable from its presenting the well-marked appearance of an incomplete bony partition connecting the anterior half of the nasal bones vertically with the osseous floor of the nasal cavity. (See Plate XV.) When the specimen first came under the inspection of Mr. Owen, he was induced to refer it, on account of this septum, to the '*Rhinoceros à narines cloisonées*,' or *Rhinoc. tichorhinus* of Cuvier, and it is quoted as such in his Report to the British Association in 1843. But when submitted to a more rigorous examination, at a subsequent period, the practised eye of this eminent palæontologist detected in it important points of difference irreconcilable with *Rhinoceros tichorhinus*; and having faith in the accuracy of the confidently-expressed, but erroneous conclusions of Christol, respecting the presence of a septum in Cortesi's cranium, he was naturally led to identify the Clacton skull with the *Rhinoceros leptorhinus* of Cuvier. This conviction was strengthened by the examination of a ramus of the lower jaw, also found by Mr. Brown in the same deposit at Clacton, which Professor Owen concluded was identical with lower jaws from Tuscany, referred by Cuvier to his *Rhinoceros leptorhinus* (Oss. Foss., tom. ii. Pl. IX. figs. 8 and 9); and with the lower jaw from the Rhine, referred by Kaup to *Rhinoceros Merckii*. The Clacton, Tuscan, and Rhenish specimens were included under the common designation of *Rhinoceros leptorhinus*.

The great weight of Professor Owen's authority was evinced in the accounts given by other palæontologists of *Rhinoceros leptorhinus* after 1846. De Blainville, in his 'Ostéographie,' although at variance upon some points of detail, admitted the Clacton skull into his limitation of *Rhinoceros leptorhinus*, with which he combined the Rhinoceros of Montpellier, of Marcel de Serres, and the *Rhinoc. megarhinus* of Christol. But he eliminated the Rhenish materials, referred by Jäger and Kaup to *Rhin. Merckii*, and referred them to *Rhinoceros incisivus*, being in his view the male of the Miocene *Aceratherium incisivum* of Eppelsheim! This portion of De Blainville's palæontological labours has met with severe strictures from some of his own countrymen, and with stern condemnation by Kaup.

Laurillard, in 1849, in his revision of the Fossil Species of Rhinoceros, presents *Rhinoceros leptorhinus* in a manner which attempts to combine the irreconcilable conceptions of

Cuvier and of Owen. He admits the partial bony septum described by the latter, and even concedes three fossettes to the upper molars, as in *Rhin. tichorhinus*, excepting only the last true molar; while he attributes to it the slender proportions inferred by Cuvier, and assigns for its habitat Italy and the Pliocene formations of England. Laurillard admitted also *Rhin. megarhinus* of Christol, or *Rhin. Monspessulanus* of De Blainville, as a distinct species. He refused to accept the *Rhin. Merckii* of Jäger and Kaup, and the *Rhin. elatus* of Croizet he regarded as referable either to *Rhin. megarhinus* or to *Rhin. leptorhinus*.

Gervais has devoted much study to the fossil species of Rhinoceros, occurring in the Pliocene and Post-Pliocene deposits of Auvergne and the South of France. The results are embodied in the 'Paléontologie Française.' He adopts the *Rhin. megarhinus* of Christol, yet although that species is described by all original observers, himself inclusive, as devoid of a bony septum, he considers it probable that the Clacton cranium figured by Professor Owen as of *Rhin. leptorhinus* belongs, notwithstanding its septum, to that form. On the other hand, he doubtingly admits the *Rhin. leptorhinus* of Cuvier as a distinct species, occurring in Italy and the Velay. He has applied the designation of *Rhin. Lunellensis* to the remains of a species discovered in the Cave of Lunel-viel, first named *Rhin. minutus* by Marcel de Serres, Dubrueil, and Jean-jean, under a mistaken interpretation of the age of the teeth, and at a later date described as being identical with the *Rhin. Africanus*. He has repeatedly directed the attention of palæontologists to the important fact, that this fossil species of Lunel-viel is hardly, if at all, distinguishable from the existing two-horned Rhinoceros of the Cape.

Pomel, in his 'Catalogue,' published in 1854, after a study of the remains occurring in Auvergne and the Velay, admits *Rhin. leptorhinus* with a bony nasal septum, as defined by Professor Owen, but under the designation of *Atelodus leptorhinus*; and gives for its habitat England, the Milanese, and the valley of the Rhine. Under another name, *Atelodus elatus*, he includes the *Rhin. elatus* of Croizet, and the *Rhin. megarhinus* of Christol. A third species, exclusive of *Rhin. tichorhinus*, he designates *Atelodus Aymardi*, and refers to it, as a synonym, the *Rhin. leptorhinus* of Gervais.

Duvernoy, the successor of Cuvier and De Blainville in the chair of Comparative Anatomy, attempted a revision of the Fossil Species of Rhinoceros, in a very elaborate memoir published in 1854. In the section devoted to the Pliocene species, he maintains, with many details, that the *Rhin.*

DESCRIPTION OF PLATE XV.

Rhinoceros hemitœchus.

The figures in this Plate represent the 'Clacton Skull' in the British Museum (Cat. No. 27,836, not 132,133, as stated in text), described by Professor Owen, in the 'British Fossil Mammalia,' as *Rhinoceros leptorhinus*. The figures have been copied from original drawings executed for Dr. Falconer by Mr. Dinkel, and are one-ninth of the natural size. (See pages 317 & 351.)

Fig. 1. Profile view of cranium, showing partial nasal septum projecting downwards.

Fig. 2. Under surface. The posterior portion is only drawn in outline. At the anterior extremity is seen the nasal septum.

Fig. 3. Upper surface of cranium.

Fig. 4. Section of the nasal septum, one-third of the natural size.

Fig. 1.

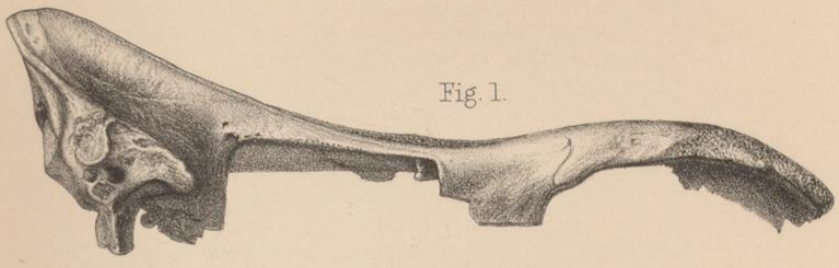


Fig. 2.

Fig. 4.

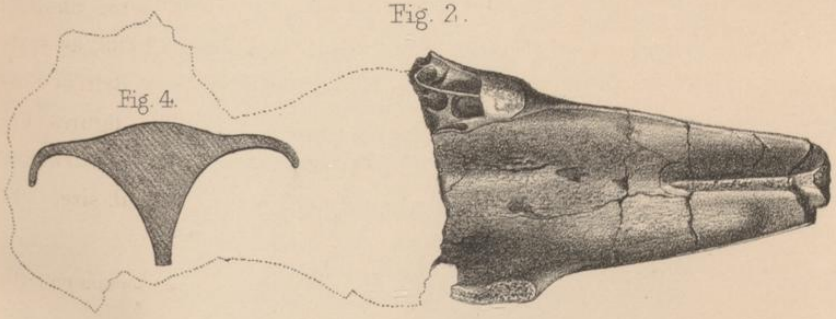
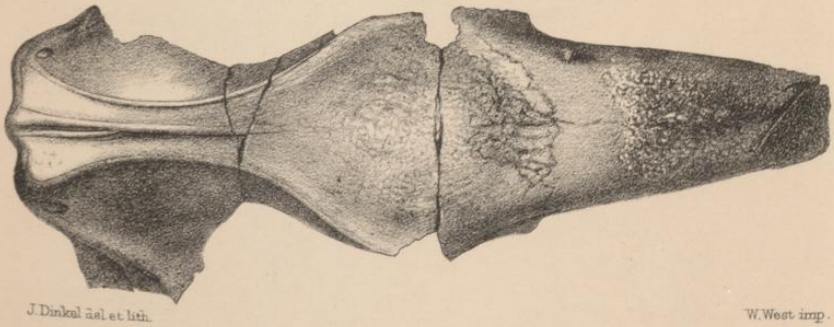


Fig. 3.



J. Dinkel del. et lith. W. West imp.

Rhinoceros hemitœchus.
(The Clacton Skull.)

leptorhinus, as established by Cuvier, was a sound species; and that Cortesi's cranium was entirely devoid of a bony septum, according to the positive evidence of Dr. Cornalia. To this *Rhin. leptorhinus* he refers the *Rhin. megarhinus* of Christol, and the *Rhin. Monspessulanus* of Marcel de Serres. He regards the Clacton cranium, described by Professor Owen, as wholly distinct from *Rhin. leptorhinus*, and, although still different, as being more closely allied to *Rhin. tichorhinus*. He proposes for it provisionally the specific designation of *Rhin. protichorhinus*, as an independent form. Not the least remarkable result of Duvernoy's inquiries was, that he identified, as certainly belonging to *Rhin. tichorhinus*, the representations figs. 8 and 9, Pl. IX. of the 'Ossemens Fossiles,' which Cuvier adduced as typical illustrations of the lower jaw of *Rhin. leptorhinus*, from specimens found in the Val d'Arno; and upon which Professor Owen mainly relied, in identifying the lower jaw from Clacton with the latter species! A more signal illustration could not be adduced of the diametrically opposite conclusions which may be drawn by different palæontologists from the same evidence, when presented in the form of imperfectly executed figures.

Lastly, Brandt, in his very complete and valuable monograph of the Rhinoceros of Siberia, published in 1849, reviews the figures and description of the Clacton skull given by Professor Owen, and expresses the opinion that it does not belong to *Rhin. leptorhinus*, but to an individual of *Rhin. tichorhinus*, in which the septum was not completely ossified. He gives a representation of a Siberian instance of this nature, corroborating the cases previously cited by Pallas and Collini.

In order to show at a glance the range and fluctuation of opinion on this palæontological question, it may be useful to summarize them in a few words:—

1. 1812. *Rhinoceros tichorhinus*, established by Cuvier as characterized by its bony nasal septum.
2. 1819. The 'Rhinoceros of Montpellier' (*Rhin. Monspessulanus*, De Blainv.), proposed by Marcel de Serres as a distinct form; identified by Cuvier (1822) with *Rhinoc. tichorhinus*; tacitly abandoned by De Serres.
3. 1822. *Rhinoceros leptorhinus*, proposed by Cuvier upon Italian specimens as destitute of a bony septum.
4. 1828. *Rhinoceros elatus*, of the Velay, proposed by Croizet and Jobert.
5. 1834. The absence of a bony nasal septum in Cuvier's *Rhinoc. leptorhinus*, denied by De Christol; the name regarded as a synonym, merely, of *Rhinoc. tichorhinus*.
6. 1834. The 'Rhinoceros of Montpellier,' reproduced by De Christol under the name of *Rhinoc. megarhinus*, as identical with

Rhinoc. incisivus of Cuvier, but distinct from *Rhinoc. tichorhinus* and from the supposed *Rhinoc. leptorhinus*.

7. 1838. *Rhinoceros primigenius*, proposed by Bronn, in the 'Lethæa Geognostica,' to include the *Rhinoc. tichorhinus* and *Rhinoc. leptorhinus* of Cuvier, in conformity with the views of Christol.
8. 1839. *Rhinoceros Merckii* (syn. *Rhinoc. Kirchbergense*, Jäg.) proposed by Jäger (1839), and by Kaup (1841), as a distinct form.
9. 1842. *Rhinoceros de Filippi*, proposed by Balsamo Crivelli, for remains occurring in the Lignite of Leffe (Gandino) as distinct alike from *Rhinoc. tichorhinus* and *Rhinoc. leptorhinus*.
10. 1846. *Rhinoceros leptorhinus* of Cuvier, reproduced by Owen upon British fossil specimens, but invested with a bony septum, and *Rhinoc. Merckii* identified with it; *Rhinoc. megarhinus* or *R. Schleiermacheri*, held to be distinct.
11. 1847. *Rhinoc. leptorhinus* admitted by De Blainville, as *with* or *without* a bony nasal septum; *Rhinoc. megarhinus* combined with it; but *Rhinoc. Merckii* transferred to *Rhinoc. incisivus*.
12. 1849. *Rhinoc. leptorhinus* of Cuvier, accepted by Laurillard, in the view of Owen, as having a bony septum; *Rhinoc. megarhinus* of De Christol held to be distinct.
13. 1849. The *Rhinoceros leptorhinus* of Cuvier accepted by Brandt, but the *Rhinoc. leptorhinus* of Owen identified with *Rhinoc. tichorhinus* (!).
14. 1852. Undecided opinions entertained by Gervais, who adopts the *Rhinoc. megarhinus* of De Christol, and leans to the view that the *Rhinoc. leptorhinus* of Cuvier, founded on Cortesi's cranium, and of Owen, are of the same species; but that the Rhinoceros remains of the Velay (*Rhinoc. elatus*, Cuv.) and of the Val d'Arno belong to another distinct form.
15. 1854. *Rhinoc. leptorhinus*, adopted by Pomel, in the view of Owen, as having a bony septum, under the name of *Atelodus leptorhinus*; and another species, besides *Rhinoc. tichorhinus*, proposed under the name of *Atelodus Aymardi*, as also having a bony septum; the *Rhinoc. elatus* of Croizet, identified with *Rhinoc. megarhinus*, under *Atelodus elatus*.
16. 1854. The *Rhinoceros leptorhinus* of Cuvier, reproduced by Duvernoy as destitute of a bony septum; *Rhinoc. megarhinus* identified with it; and the *Rhinoc. leptorhinus* of Owen erected into *Rhinoc. protichorhinus*.

The above table suggests a grave and instructive comment on the uncertainty of palæontological determinations, even when guaranteed by names of the highest authority. The point upon which hinged the discussion, protracted during upwards of twenty years, was, 'Had *Rhinoc. leptorhinus* an osseous nasal septum, or had it not?' The pendulum oscil-

lated between septum and no septum. The array of authorities on either side was nearly balanced, with the exception of a discreet few headed by De Blainville, who followed the convenient *via media* and argued that the character was of little importance, being but a degree, more or less, of ossification of the nasal cartilage, and that, according to circumstances of age, sex, or vigour in the species, might, or might not, have had the partition ossified. Considering that the cranium upon which Cuvier relied has been deposited during nearly half a century in one or other public museum in Milan, on the high road of continental travel, it might have been expected that the disputed point would have been speedily settled by an appeal to the original specimen. But until the appearance of Crivelli's evidence in 1842, confirmed by Cornalia in 1854, the Cortesi cranium, upon which the case rested, does not appear to have been examined by any one of the numerous palæontologists all over Europe who took a share in the dreary discussion.

It will be admitted that an essay to determine with precision a single form, out of such a class of confused synonymy and perplexed opinions, will be of some service to Palæontology. This I shall endeavour to do with the Clacton species, hitherto described under the name of *Rhin. leptorhinus*; and it has appeared to me to be better to give it a new specific name, than to attempt to identify it conjecturally with some one of the names that have already been proposed for forms supposed to be different from the *Rhin. leptorhinus* of Cuvier. The *ad interim* designation, suggested by Duvernoy, for the Clacton species of *Rhin. protichorhinus*, is manifestly inadmissible. Whether *Rhinoceros hemitœchus* may not be identical with some of the materials figured and described by Kaup, under the name of *Rhin. Merckii*, I am unable to determine satisfactorily. The upper molars from Chagny and Crozes, figured by Cuvier, which Kaup refers to that species, differ materially in the form of the 'crochet,' a character of great significance, from those of *Rhin. hemitœchus*. The same uncertainty applies to the *Atelodus Aymardi* of Pomel, from the Velay, so named in his 'Catalogue Méthodique,' but without figures or sufficient distinctive characters to establish the species. *Rhinoceros hemitœchus* certainly differs from *Rhin. leptorhinus* of Cuvier, as founded on Cortesi's cranium, which I have examined, both in the dental characters and form of the skull, and also in the general proportions of the skeleton; and it differs equally from the *Rhinoceros megarhinus* of De Christol, skulls and other remains of which I have examined at Lyons and Montpellier. If the distinctness of the species is established, and its range in time and geographical distribu-

tion over Europe are determined, my object in this communication will have been attained. It is left to systematic writers on Palæontology to decide by what specific designation the form here called *Rhinoceros hemitœchus* shall hereafter be recognized. In the meantime, the name now applied will be of convenience to geologists in dealing with the Mammalian remains of one period of the Caves, and of deposits of the age of Clacton, and certain localities in Northamptonshire as distinct, on the one hand, from the 'Elephant-bed' of the Norwich coast, and on the other, from the superficial gravels of the Glacial period.

My first acquaintance with the species dates from the spring of 1858, when, on a visit to Plymouth, to examine the remains of the Oreston caves, I saw in the possession of Mr. Spence Bate a beautiful drawing (which he liberally placed at my disposal) of a ramus of the lower jaw of a Rhinoceros, discovered by Colonel E. R. Wood in 'Bacon Hole,' which a cursory examination satisfied me differed alike from *Rhin. leptorhinus* and from *Rhin. tichorhinus*. (See Pl. XXI.) On proceeding to Swansea, in company with my friend the Rev. Robert Everest, I compared the original of Mr. Spence Bate's drawing with a fine specimen of a corresponding ramus of the lower jaw of a fossil Rhinoceros, from the Elephant-bed' of the Norfolk coast, belonging to the collection of the Rev. John Gunn of Irstead,[1] which I had previously inferred to be of *Rhinoceros leptorhinus* of Cuvier, as met with in the valley of the Po and the Val d'Arno. In the Museum of the Royal Institution of South Wales at Swansea, besides the specimen in question, I found the right and left rami of another lower jaw, containing on the left side the series of the six posterior molars in beautiful preservation (Pl. XIX.), together with a fragment composing four consecutive molars of the upper jaw, right side (namely the penultimate and antepenultimate true molars, and the two posterior premolars), and likewise some vertebræ and fragments of bones of the extremities. The whole of these remains were discovered in 1850 in the cave of 'Bacon Hole,' in Gower, about six miles west of Swansea, during an exploration carried on by Colonel E. R. Wood, of Stout Hall, by whom they were presented to the Swansea Museum. The character of the upper molars established to a certainty the distinctness of the species. On communicating this result to Colonel Wood, I was informed by him that in another of the Gower Caves, named 'Minchin Hole,' the exploration of which he had undertaken after exhausting 'Bacon Hole,' he had dis-

[1] See *antea*, p. 349.—[Ed.]

covered the entire cranium of an adult Rhinoceros with the series of molars complete on both sides, the nasal bones perfect to their tips, and a well-pronounced partial bony septum connecting the anterior portion of the nasals with the floor of the nostrils. This most precious and unique specimen met with a grievous accident, by which it was crushed and destroyed whilst temporarily out of Colonel Wood's hands; and all that now remains of it is the palate, with the line of molars on either side, which is deposited in the Museum of the College of Surgeons. I found in Colonel Wood's rich collection at Stout Hall a very fine specimen comprising the cerebral part of another cranium of the same species of Rhinoceros, the facial portion of which appears to have been broken and destroyed by the workmen during extrication from the floor of the cavern. This fragment will be described in the sequel.[1]

Colonel Wood, on being made aware of the important nature of the result of his researches, immediately recommenced the operations, which had been temporarily suspended, in 'Minchin Hole,' and discovered a large number of additional remains of the same species. These I had an opportunity of examining on a second visit to Gower during last autumn, and the whole series has been liberally placed at my disposal by Colonel Wood.

My attention was next directed to ascertaining whether the Gower form occurred in any other of the ossiferous caverns in England; and on proceeding to Bristol, I found in the very interesting series of fossil remains, discovered by Mr. Stutchbury, in Durdham Down, several upper molars specifically identical with those of the Rhinoceros of Bacon Hole and Minchin Hole.[2] The same result followed an examination of the Rhinoceros remains from 'Oreston,' near Plymouth, described by Mr. Whidbey in 1817,[3] and now preserved in the Museum of the College of Surgeons.[4] They all proved to belong to the same species. I next instituted a comparison between the upper molars discovered by Mr. John Brown, F.G.S., at Clacton and the Gower specimens, with the same result.[5]

The materials available for the description of the species are therefore very abundant, including specimens, more or less complete, of at least four crania of different ages; five upper jaws presenting the molars in different stages of wear; eleven rami of the lower jaw, young and old; together with fragments of most of the principal bones of the extremities.

[1] See paper on the Gower Caves, and also pp. 350 to 352.—[Ed.]
[2] See Appendix, No. II., p. 349.—[Ed.]
[3] Philosoph. Trans., 1817.
[4] See Appendix, No. IX., p. 353.—[Ed.]
[5] See Appendix, No. V., p. 351.—[Ed.]

With the exception of two of the skulls, all the specimens here enumerated are the products of Colonel Wood's zealous and meritorious researches in the Gower Caves. On the present occasion, I shall confine myself to the description of such specimens only as are essential to establishing the specific distinctness of the form.

Characters of the Molar Teeth.—The crowns of the upper molar teeth in Rhinoceros present a common pattern of great complexity, but subject to modifications in the different species that are very constant, thus furnishing good characters for distinguishing them. Cuvier gave such a clear and complete analysis of the elements that enter into the composition of the crown, and was so happy and simple in the terms by which he designated them, that little was left to his successors besides the application of these terms to the new forms discovered after his time. De Christol followed up and extended the observations of Cuvier with much ability, in his Essay on the European Fossil Species, and succeeded more especially in tracing the peculiarities of character produced by the attachment of the distal end of the 'crochet' to the contiguous parts, or by its remaining free. The other points of principal importance to be regarded are the number of fossettes on the worn triturating surface; the presence or absence of an internal basal bourrelet to the three last premolars; the form of the hind barrel of the last true molar in respect of its being either simple and undivided, as in most of the species fossil or recent, or divided by a posterior figure or fossette, which is so distinctive a character of *Rhinoceros simus*, among the living, and of *Rhinoceros tichorhinus* among the extinct forms; and lastly, the relative thickness of the coat of cement, a character the value of which in the species of Rhinoceros has, in some measure, been hitherto overlooked.

Fig. 1 of Pl. XVI. represents a fine fragment of the upper jaw, right side, belonging to the collection of Colonel Wood. It contains the five last molars in perfect preservation; *i.e.* the penultimate and last premolars, with the three true molars. The antepenultimate premolar (p.m. 2) has been appended in outline, from a reversed figure of the tooth on the opposite side of the same individual. The age and relative stage of wear in the different teeth are such as to present the characters in the most favourable manner. The antepenultimate true molar (m. 1) is so far advanced in wear, that the posterior fossette is reduced to a small oval pit; on the penultimate (m. 2) the detrition is so little advanced, that the same valley is not yet isolated, and the peculiar form of the 'crochet,' which constitutes one of the

DESCRIPTION OF PLATE XVI.

Rhinoceros hemitœchus.

The figures in this Plate represent molars of *Rhinoceros hemitœchus* found in 'Minchin Hole,' Gower, formerly in the collection of Colonel Wood of Stout Hall, but now in the British Museum.[1] The figures are two-thirds of the natural size, and have been copied from drawings executed from the original specimens by Mr. Dinkel for Dr. Falconer. They are fully described at page 324, *et seq.*

Fig. 1. Shows the five last molars, *i.e.* the penultimate and last premolars, and the three true molars, of the upper jaw, right side. The antepenultimate premolar (p.m. 2) has been appended in outline from a reversed figure of the tooth on the opposite side of the same individual. The crochet (*a*) is well seen in the penultimate true molar. The specimen is fully described at page 324, *et seq.*

Fig. 2. Shows the four last molars of the upper jaw, right side, but considerably more worn than those shown in fig. 1. A description of these teeth will be found at pages 325 & 329. At page 325, 'left side' has been misprinted for 'right side.'

Fig. 3. Represents a detached penultimate molar of the left side, being the counterpart from the opposite side of the tooth (m. 2) represented in fig. 1. The characteristic thick massive crochet (*a*), forming an acute angle with the anterior margin of the posterior barrel, is well shown. A description of the tooth will be found at pages 325 & 329.

[1] As these pages are passing through the Press, Col. Wood has presented to the British Museum these and other specimens of Rhinoceros remains found in the Gower Caves, which are described or figured in this work.

Fig. 3.

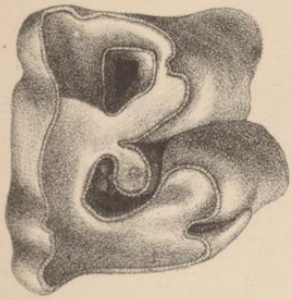


Fig. 2.

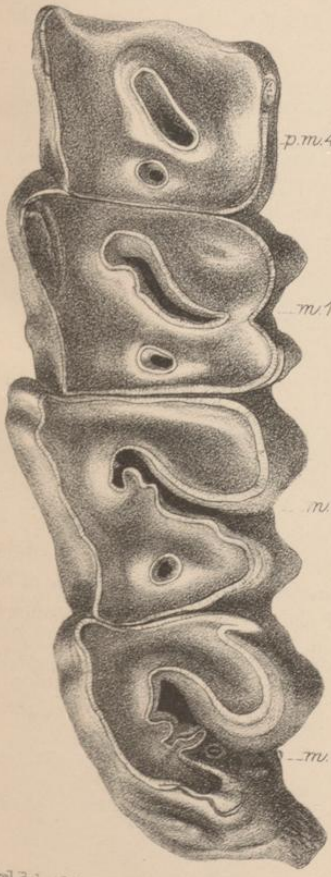
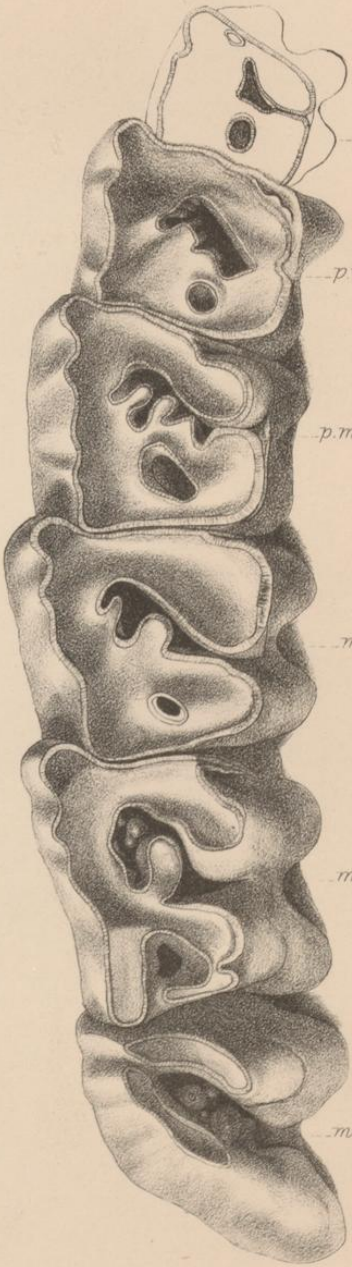


Fig. 1.



J. Dinkel del. et lith.

W. West imp.

Rhinoceros hemitœchus.

distinctive marks of the species, is well shown; while the apex of the crown of the last molar had only come slightly into use. The premolars are well worn, and in the normal ratio, to the state of the antepenultimate true molar (m. 1). All the teeth are invested by a very thick coat of cement, which is denuded from the upper part of the anterior barrel of the last molar (m. 3). The specimen was yielded by the last excavations in 'Minchin Hole.'

Fig. 2 of Pl. XVI. represents another fine fragment in Colonel Wood's collection, composing the four last molars, also of the left side of the upper jaw, but considerably more worn, the crowns of the last premolar (p.m. 4) and of the antepenultimate true molar (m. 1) being ground down to a uniform surface, each enclosing two fossettes; while the last true molar (m. 3) shows the various folds of enamel, and the form of the 'crochet' in the stage of abrasion best suited for exhibiting the characters. All the teeth in this specimen also are enveloped by a thick coat of cement. It was yielded by 'Minchin Hole.'

Figs. 1 and 2 of Pl. XVII. represent a fragment of the right side of the upper jaw, containing three consecutive teeth, namely, the last premolar mutilated at the outer surface, and the antepenultimate and penultimate true molars, the latter having the inner side of the posterior barrel fractured. The crowns are in a less advanced stage of wear than in the two preceding specimens, and the last premolar presents a modification in the disposition of the fossettes, to be noticed in the sequel. The specimen belongs to the Swansea Museum, and was discovered by Colonel Wood in 'Bacon Hole.' The enamel in all the teeth is invested with a very thick layer of cement.[1]

Figs. 3, 4, and 5 of Pl. XVII. represent different views of a detached germ of the last true molar, upper jaw, left side, which has not yet come into use. It is free from any coat of cement, thus presenting all the folds and depressions of the enamel-shell in a perfect manner.

Fig. 3 of Pl. XVI. represents a detached penultimate molar of the left side, being the counterpart, from the opposite side, of the tooth (m. 2) represented in fig. 1 of the same plate.

These specimens are all drawn two-thirds or three-fourths of the natural size, and taken together they furnish a complete view of the characters of the upper molars, with

[1] The dimensions of this specimen are given in Dr. Falconer's note-book as follows:—

'Length of three molars, 5·9 in. Length of last molar, outer surface, 2·9 in. Width of ditto, in front, 2·2 in. Length of penultimate, outer surface, 2·2 in. Width of ditto, in front, 2·3 in. Length of last premolar, broken, 1·75 in.'—[Ed.]

the exception of the small and deciduous first premolar, which is rarely seen *in situ*.

Premolars.—The premolars (Pl. XVI. fig. 1, p.m. 2, 3, and 4) in *R. hemitœchus* belong to the series indicated by Cuvier, in which there are only two fossettes produced by wear on the grinding surface. The antepenultimate (p.m. 2) presents a nearly square crown; and the median termination of the transverse valley is reduced to a triangular fissure, which on the inner side is not quite isolated, the anterior and posterior divisions not been ground down sufficiently to efface the intervening cleft. The posterior valley is isolated and reduced to an elliptical fossette.

The penultimate premolar (p.m. 3), as is usual in the genus, presents a sudden and very considerable increase of size beyond the antepenultimate. The inequalities of the crown are worn down to a common plane, the middle of which is occupied by a large and irregular fissure, being the isolated termination of the middle valley; and a round fossette indicates the remains of the posterior valley. The hinder boundary of the middle fissure forms a flexuous edge composed of two projecting rounded lobes, being the remains of a bifid 'crochet.' Several small tubercles are seen rising up from the bottom of the fissure.

The last premolar (p.m. 4) is presented in three different stages of wear by the different specimens. In the 'Bacon Hole' fragment (Pl. XVII. figs. 1 and 2), the abrasion of the crown (p.m. 4) is so little advanced that the posterior valley is not yet isolated; the anterior and posterior barrels are separated by a wide and deep valley, which is nearly straight and of uniform width. Its posterior boundary is undulated, but free from any considerable projection directed from the posterior towards the anterior barrel. A portion of the termination of the middle valley is already detached, forming a third fossette. This, however, is an individual variety, that is not uncommon in either the penultimate or last premolars of species which have ordinarily but two fossettes. It occurs occasionally in the premolars of *R. bicornis*, and Gervais has figured an instance of the same kind occurring in a premolar of *R. megarhinus*. The portion of the crown corresponding with the outer or longitudinal ridge is broken off, in this specimen; but the loss does not interfere with the principal character.

A more advanced stage of wear and a different pattern are seen in the same tooth (p.m. 4) as presented by fig. 1 of Pl. XVI. The posterior valley forms a large detached oval fossette. The inner side of the crown is worn so low that the barrels are almost confluent, and the commencement

DESCRIPTION OF PLATE XVII.

RHINOCEROS HEMITŒCHUS.

The figures in this Plate represent molars of *Rhinoceros hemitœchus* found in the Gower Caves by Colonel Wood. The figures are three-fourths of the natural size, and have been copied from drawings executed from the original specimens for Dr. Falconer by Mr. Dinkel.

Figs. 1 and 2. Show in plan and profile a fragment of the right side of the upper jaw, containing the last premolar mutilated at the outer surface, and the antepenultimate and penultimate true molars, the latter having the inner side of the posterior barrel fractured. The crowns are in a less advanced stage of wear than in the specimens represented in figs. 1 and 2 of Plate XVI. (See pages 325 & 332.)

Figs. 3, 4, and 5. Represent three different views of a detached germ of the last true molar, upper jaw, left side, which had not yet come into use, and which presents all the folds and depressions of the enamel-shell in a very perfect manner. Fig. 3, crown surface. Fig. 4, inner surface. Fig. 5, outer surface. *a*, anterior colline; *b*, longitudinal colline; *c*, the continuation of the longitudinal colline which is the homologue of the posterior transverse colline; *d*, the crochet; *e*, the anterior barrel; *f*, the anterior basal bourrelet; *g*, the posterior barrel; *h*, a small tubercle at the posterior inner angle; *i*, vertical groove of the anterior outer angle; *k*, intercolumnar tubercle. (See pages 325 & 335.)

Fig. 1.

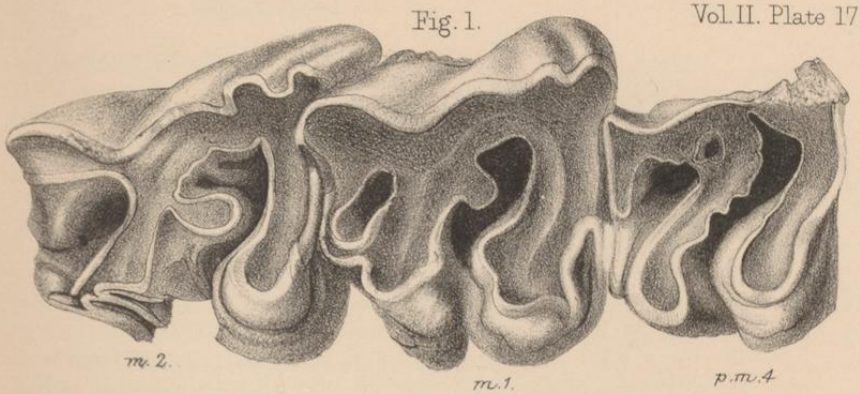


Fig. 2.

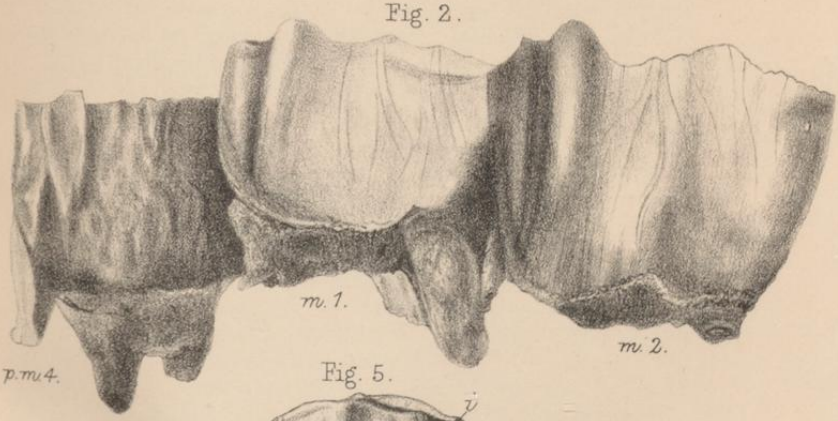


Fig. 5.

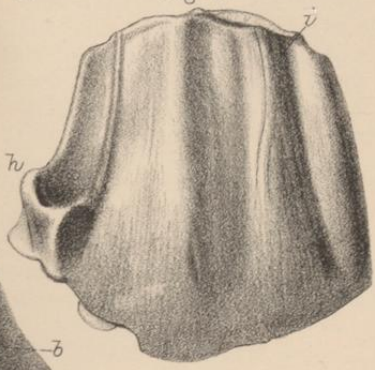


Fig. 3.

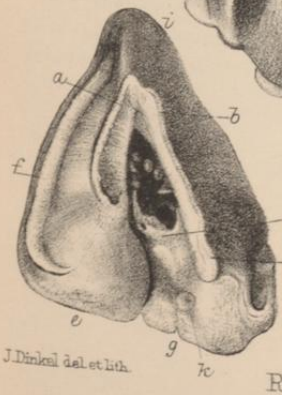
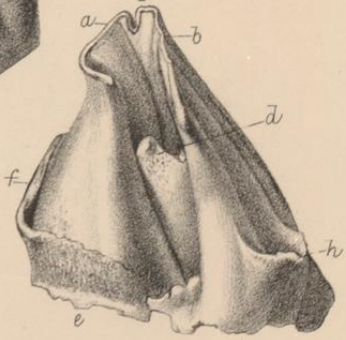


Fig. 4.



J. Dinkel del. et lith.

Rhinoceros hemitœchus.

W. West imp.

of the middle valley nearly effaced. The central fissure forms a very irregular chasm deeply indented by the salient processes of a bifid 'crochet' thrown off in front of the posterior fossette, and by a thick projecting plate given off from the middle of the longitudinal outer ridge and converging towards the top of the crochet. If during the further progress of wear the points were to run together into a common surface, a third detached fossette would be formed, exactly as is seen in the preceding specimen, and the anterior border of the posterior colline would present only a slight amount of undulation, instead of the numerous salient plates or denticulations yielded in its present state. These processes are less conspicuous in the penultimate premolar (p.m. 3), in consequence of its more advanced stage of wear, which has led to their disappearance; but the two lobes of the bifid 'crochet' are distinctly discernible in the latter tooth.

A third condition of the last premolar is furnished by the anterior tooth (p.m. 4) of Pl. XVI. fig. 2. Here the abrasion of the crown has proceeded so far that the transverse valley is reduced to a diagonal excavation, oblong in form, with rounded ends and parallel sides. The enamel boundary of this fossette is perfectly smooth and equal, the projecting processes of the bifid 'crochet' having entirely disappeared; and the posterior valley is reduced to a small round pit. On the inner side the waste of the crown by grinding has gone so far that no indication remains of its having been originally composed of two distinct barrels.

These three examples furnish an instructive series of illustrations of the very different patterns which may be presented in this species by the same tooth in different stages of abrasion. In each case the tooth is fortunately in place in the jaw in connection with other molars, which determine its rank and numerical position with certainty. Had they been found detached it would have been but conjectural to identify p.m. 4 of fig. 2 (Pl. XVI.) with the complex crown of p.m. 4 in fig. 1 (Pl. XVI.).

I have seen other detached premolars of *R. hemitœchus* from various localities, all presenting the same characters, that is to say, the hind barrel projecting into the central fossette a bifid 'crochet,' and an accessory parallel plate emitted from the middle of the outer or longitudinal ridge, forming together three 'combing plates' of a complex pattern, as in p.m. 4 of fig. 1 (Pl. XVI.). Two specimens of this nature, from the cavernous fissure of Durdham Down, are preserved in the Bristol Museum. They are contiguous premolars of the upper jaw, left side.[1]

[1] See Appendix, No. II., p. 350.—[Ed.]

Another character of much importance, as a specific distinction, is that the premolars of the Rhinoceros of the Gower Caves are constantly devoid of an internal basal bourrelet.

Having regard to the various points above indicated, the premolars of *R. hemitœchus* may be characterized :—

1. By the absence of an internal basal bourrelet.
2. By there being two fossettes only to the worn crowns.
3. By the middle valley being traversed by the processes of a bifid crochet emitted from the posterior barrel, and by a parallel combing plate given off by the outer or longitudinal ridge.
4. By being invested, like the true molars, with a very thick coat of cement.

The presence of only two fossettes instead of three at once distinguishes these premolars from those of *Rhin. tichorhinus*, while the absence of a basal bourrelet, besides other characters, distinguishes them from *Rhin. megarhinus* and *Rhin. leptorhinus*. Among existing species, *Rhin. bicornis* resembles the Gower fossil form in the bifid crochet and combing plate which project into the 'cul de sac' of the middle valley; but it differs materially in the strongly developed crenated bourrelet, which encircles the inner side of the premolars.

De Christol has figured two varieties of the last upper premolar in *Rhin. megarhinus*, in one of which (fig. 10 of Pl. III.) there is a very pronounced basal bourrelet, while the other (fig. 4 of Pl. III.) is entirely free from it (Pl. XVIII. figs. 1 and 2 of this work).[1] The teeth correspond so exactly in every minute detail of pattern in other respects, that it is impossible to doubt that they are of the same species. The tooth, fig. 4, agrees also with the last premolar of *Rhin. hemitœchus* (p.m. 4 of fig. 1, Pl. XVI.), in the absence of a bourrelet, in the 'crochet' being bifid, and in emitting a single combing plate from the outer ridge. But on instituting a minute comparison, the following points of difference are discernible. In the premolars of *Rhin. megarhinus* and also of *Rhin. bicornis* the 'combing plate' (R. of figs. 10 and 4 of De Christol) is emitted in a line with the anterior outer angle, and converges diagonally to meet the plane of the crochet (T.) nearly at a right angle; and the

[1] Annales des Sciences Nat. 2me Sér. tom. iv. Zool. In Dr. F.'s MSS. the figures cited from De Christol are 'figs. 25 and 19,' which correspond to figs. 10 and 4 in Pl. III. of the memoir in the 'Annales des Sciences,' there being seven figures in Pl. I., eight in Pl. II., and fifteen in Pl. III. The latter figures, moreover, correspond with copies which Dr. F. had made from those numbered 25 and 19. These figures have been reproduced in figures 1 and 2 of Pl. XVIII. of this work.—[Ed.]

processes of the bifid crochet do not project much into the valley. On the other hand, in *Rhin. hemitœchus*, the 'combing plate' (p.m. 4 of fig. 1 of Pl. XVI.) is given off from the middle of the longitudinal or outer ridge, and is directed forwards nearly parallel to the upper lobe of the crochet; and both these processes jut more into the valley and are more massive. These alleged points of difference may be regarded as minute and fine-drawn, but they have appeared to me to be constant, and to run through the whole series of the molars.

I do not consider it necessary, on the present occasion, to extend the comparison of the premolars of the Gower Rhinoceros with those of other species.

True Molars.—The distinctive characters of the teeth in this species are still more pronounced in the upper true molars. Fig. 3 of Pl. XVI. represents a detached penultimate of the left side, in the most favourable stage of wear to show the characters. The posterior valley, not long isolated, forms an irregular triangular pit with sloping walls. The transverse valley at its commencement also forms a triangular fissure with the apex pointing to the sinus between the posterior barrel and the crochet; the valley next bends forward in a sigmoid curve, and is very much contracted by the advance of the crochet towards the anterior barrel; and it then expands into a rounded cul de sac, the extremity of which points backwards. During the progress of wear the two valleys never form more than two fossettes, in the manner exhibited by m. 1 of fig. 2 (Pl. XVI.), which presents the antepenultimate or first true molar in a very advanced stage of abrasion. This character, as in the case of the premolars, at once distinguishes the molars of *Rhin. hemitœchus* when found detached from those of *Rhin. tichorhinus*.

But the character which best distinguishes them from all other species lies in the peculiar form of the 'crochet,' or promontory projected forward from the posterior colline into the transverse valley. In all the species, fossil or recent, excepting *Rhin. hemitœchus*, the crochet forms a plate which is emitted at a very open angle with the posterior colline, and directed more or less diagonally towards the anterior outer corner of the crown. This is well seen in the figures given by Cuvier in the 'Ossemens Fossiles.'[1] Pl. V. figs. 1, B. C., and Pl. II. fig. 3, B. of that work exhibit the character in the unicorned Rhinoceros of Java, where the margin of the crochet is continued nearly in a straight line with the anterior margin of the posterior colline. The same is seen in the penultimate B. of fig. 1, Pl. XVIII., representing the

[1] Éd. 3me. tom. ii. *Rhinoceros.*—[Ed.]

adult dentition of the two-horned Rhinoceros of the Cape. For the other existing species, the beautiful figures given by De Blainville in the 'Ostéographie' may be referred to generally in illustration of the same character. In *Rhin. tichorhinus* the crochet is given off at a very open angle, and is united with the 'combing plate' of the outer ridge, so as to form the third fossette; the same occurs in the molars of *Rhin. simus*, which in their general plan bear a close affinity to those of *Rhin. tichorhinus*. In regard to the other fossil species, there are but few specimens figured in the 'Ossemens Fossiles' that can be referred to in illustration. The molar from Chagny (Département du Saône et Loire), Pl. VI. fig. 6, cited by Kaup, as an illustration of his *Rhin. Merckii*, is far advanced in wear, but what remains of the 'crochet' exhibits the same very open angle in its offset from the posterior barrel. Of the two molars from Crozes (Départ. du Gard), also cited by Kaup as of *Rhin. Merckii*, and adduced by Professor Owen as identical with his *Rhin. leptorhinus* of Clacton, the specimen fig. 5 of Pl. XIII. is ground down so low that the crochet has nearly disappeared, and it is therefore hardly a suitable case for comparison; but if it is compared with m. 2 of fig. 2, Pl. XVI. of the accompanying illustrations, being a penultimate of *Rhin. hemitœchus* which is nearly in a corresponding state of abrasion, it is manifest that in the former the curve of the crochet forms a much less abrupt flexure than in the latter. The second Crozes specimen (Oss. Fossiles, *Rhin.*, Pl. XIII. fig. 4) is an abnormal case, the nature of which has been clearly explained by De Christol, in which the crochet is so produced as to be concrete with the middle of the anterior colline, thus leading to the early isolation of a third fossette, in a manner different from what occurs, as an ordinary condition, either in the true molars of *Rhin. tichorhinus* or in any other known species. But although so little worn, that the posterior valley is not yet isolated into a fossette, if the figure given by Cuvier is compared with fig. 3 of Pl. XVI. of the accompanying illustrations, it will be seen that the anterior edge of the posterior colline does not form an acute angle and a re-entering niche with the base of the crochet.

Of the European fossil forms from the Pliocene and more recent deposits, *Rhin. megarhinus* is that of which the dentition is best known, after *Rhin. tichorhinus*. The excellent descriptions and figures supplied first by De Christol, and afterwards by Gervais, leave little to be desired in regard to the cranial and dental characters of this species. In fig. 5, Pl. III. of his memoir (reproduced in Pl. XVIII. fig. 3), De Christol has given a fine illustration of the natural size

of a penultimate upper molar, of which the crown is but slightly abraded, and the 'crochet' well developed. In this case, also, the crochet forms, at its offset, a very open angle with the disc of the posterior colline. In fact, it is continued in nearly the same line of diagonal as the latter, and points to the anterior outer corner of the crown. Gervais (Paléontologie Français, Pl. II. fig. 5) has given a beautiful illustration of an upper molar (penultimate or antepenultimate) of the same species, yielding precisely the same characters (reproduced in Pl. XVIII. fig. 4); and I have, through the kindness of M. Gervais, had an opportunity of examining a considerable number of molars of the same species in the Museum of the Faculty of Sciences at Montpellier, which presented a constant agreement in the offset of the crochet from the posterior colline, at a small inclination only.

If on the other hand the penultimate true molar in *Rhin. hemitœchus* (Pl. XVI. fig. 1, m. 2, and fig. 3) be examined, the crochet (*a*) presents a thick massive body thrown straight forward, and forming an acute angle with the anterior margin of the posterior barrel. It is flat or concave above, and convex below; narrow at the base, and thickening to a blunt margin. In mass it bears a much larger proportion to the disc of the hind barrel than in most of the other species. The distal extremity is closely approximated to the anterior barrel, but always remains detached, undivided, and free from the hooked inflection, so common in the other species, which suggested the name applied to this body by Cuvier. The pattern presented by the stage of abrasion seen in fig. 3, Pl. XVI., may be compared to a boot of which the disc of the hind barrel forms the leg, and that of the 'crochet' the foot. In the corresponding molars of *Rhin. megarhinus* already cited, namely fig. 5 of Pl. III. of De Christol's memoir (reproduced in Pl. XVIII. fig. 3), and fig. 5 of Pl. II. of Gervais' Paléontologie (reproduced in Pl. XVIII. fig. 4), besides the difference of alignment in its offset from the hind barrel, the section of the crochet is wedge-shaped, thinning from a broad base to a sharp edge.

In the antepenultimate true molar, m. 1 of fig. 1 of Pl. XVI., the same general characters are presented, but modified by the greater age and more advanced abrasion of the crown. The posterior valley is reduced to an oval pit. The discs of the anterior and posterior barrels occupy much larger areas; the crochet being ground low down is greatly diminished in projection, but it still forms a right angle with the anterior edge of the posterior barrel. The cul de sac of the middle valley is reduced in size, and a 'combing plate' or fold of enamel from the outer longitudinal ridge juts into it, directed

forwards and parallel to the crochet, corresponding with what was described above of the same process in the last premolars. The origin and connection of this 'combing plate' are explained by the mammillary processes seen above the 'crochet' in the terminal expansion of the transverse valley in m. 2 of fig. 1 (Pl. XVI.). These denticuli are connected with the bottom of the fissure and with its outer wall. It is obvious that if the abrasion of the crown were carried a little further they would run together into a continuous plate, which would project into the valley parallel to the crochet, reproducing the pattern seen in p.m. 4 of the same figure, and in the last true molar, m. 3 of fig. 2 (Pl. XVI.). When this occurs a very complex pattern is the result. Cuvier has figured no examples, but in the additions to Vol. iii. of the 'Oss. Fossiles,' he refers to some teeth procured by Mr. Pentland in Tuscany, 'dont la colline postérieure, au lieu d'un seul crochet, en donne plusieurs petits en avant; ce que fait paraître cette colline dentelée vers sa base quand elle commence à s'user.' He adds, 'ce caractère pourra servir à reconnaître cette espèce (referring to *Rhin. leptorhinus*) par ces molaires.' Professor Owen had his attention directed to the same peculiarity in a fossil which he describes 'as the germ of the antepenultimate molar of a *Rhin. leptorhinus* from Grays, in Essex, in which many smaller processes are sent off into the principal valley, in addition to the large promontory,' but he was not disposed to place much stress upon this as a specific character. In *Rhin. megarhinus*, these 'combing plates' are not directed forwards, but converge from the anterior outer angle towards the crochet. I have lately ascertained, by the examination of the cast of a cranium with teeth contained in the Museum at Pisa, that *Rhin. hemitœchus* occurred in the Fauna of the Val d'Arno,[1] and the teeth so briefly yet pointedly noticed by Cuvier in the passage cited above in all probability belonged to this species. In the penultimate (m. 2) of the 'Bacon Hole' specimen (Pl. XVII. fig. 1), although not much advanced in wear, the denticuli of the 'combing plate' have run together and it is projected forwards parallel to the 'crochet,' thus confirming the constancy of the character.

The penultimate and antepenultimate upper true molars differ so little from each other, except in dimensions and some trivial details of proportion, that it is unnecessary to describe

[1] This cranium of a Rhinoceros, with a partial bony septum, was subsequently determined by Dr. Falconer to belong to *Rhin. Etruscus* (p. 359). Mention, however, is made in his note-books of a lower jaw of *Rhin. hemitœchus* in the Pisa Museum. The existence of the latter species in Italy is also mentioned in his letter to M. Lartet, already referred to, p. 309.—[Ed.]

them separately. A very advanced stage of abrasion is presented by the antepenultimate or m. 1 of fig. 2 of Pl. XVI. The posterior valley is reduced to a small pit, and the large sinuous transverse valley to a diagonal fossette, from the posterior wall of which every trace of a crochet or of a combing process has disappeared. The penultimate (m. 2) of the same figure, although less worn, has lost the greater part of the mass of the crochet by the waste of abrasion, and the middle valley, in consequence, forms a fissure of nearly uniform width, much reduced in expansion at its extremity.

Next, in regard to the last true molar. Of all the grinding teeth in the genus Rhinoceros, the last true molar of the upper jaw is that which presents the greatest difference of form and the most pronounced characters for distinguishing the species. Fortunately we possess, in the series of the Gower specimens, a complete set of illustrations, showing this tooth in every stage, from that of the intact germ up to the worn crown of the aged animal; and the modifications of form which it presents are so peculiar, and of so much systematic interest when considered in connection with the partial bony septum, that I shall not hesitate to enter into more detail in describing it than in the case of the penultimate and antepenultimate. This is the more necessary, as De Christol, the most original and weighty authority on the subject since the time of Cuvier, has omitted the last molar in his elaborate analysis, under the belief that it yielded no specific characters of importance.[1] In order to make the description clear, it is requisite to refer to the general composition of the crown of a true molar in *Rhinoceros*, as indicated by Cuvier. Taking the penultimate as the type, the crown is nearly rectangular in outline and bounded by four sub-equal sides; the outer and inner, and the anterior and posterior, forming parallel sides of the square. The outer side (*a b* of the teeth B and C of fig. 1 Pl. XLIII.,[2] Cuvier's Oss. Fossiles (supports a longitudinal ridge or colline, from either extremity of which a transverse flexuous ridge is given off at a right angle, forming (*a c*) an anterior colline, and (*b e*) a posterior colline, parallel to each other, but separated by a sinuous transverse valley. The terminations or barrels of these collines constitute the inner side of the square. The anterior side forms a straight unbroken line, and in all the species presents nearly the same uniform character, except in the greater or less amount of development of its basal bourrelet. The posterior side is the most subject to modification. It is shorter than the anterior, deeply notched by an antero-posterior fissure, generally

[1] De Christol, *op. cit.* p. 47.

[2] Corresponds to Pl. v. of Rhin. in vol. ii. of 3rd ed. 1825.—[Ed.]

triangular in form, separating the inner hind barrel from the posterior termination of the outer ridge. This fissure forms the posterior valley. All the species of Rhinoceros hitherto described may be ranged under two heads: 1. Those in which the last true molar has a posterior valley; 2. Those in which it is wanting. To the former series belong *Rhin. tichorhinus* and *Rhin. simus*, which further agree in the common character of presenting three fossettes to the worn crown of the last true molar, namely: one fossette, formed by the posterior fissure; the second, caused by the confluence of the crochet with the combing plate intercepting a portion of the transverse valley; and a third fossette, formed by the remaining or open portion of the latter valley. To the second series belong the unicorned and bicorned species of Asia, and the African *Rhin. bicornis*, together with the European fossil species, such as *Rhin. megarhinus*, *Rhin. leptorhinus*, Cuvier, *Rhin. Schleiermacheri*, &c. They all agree in the common character of the posterior valley or fossette being wanting, but are susceptible of being divided into two subordinate series, namely, those in which the last molar presents two fossettes; one formed by the confluence of the crochet with the 'combing plate' intercepting the outer portion of the transverse valley, the other, composed of its open or inner portion. This series is exemplified by *Rhin unicornis* among living forms. The second subdivision includes the forms in which the crochet is free from adhesion to the 'combing plate,' and the crown, during wear, only exhibits a single fossette, namely, the sinuous fissure of the transverse valley. To this series belong the unicorned Rhinoceros of Java, *Rhin. bicornis*, and the majority of the European fossil forms. The last true molar may therefore be presented with one fossette, as in *Rhin. megarhinus* (*vide* Gervais, Paléontol. Française, Pl. II. figs. 6 and 7); with two fossettes, as in *Rhin. unicornis* (*vide* Cuvier, Oss. Fossiles, *Rhin.*, Pl. II. fig. 3); or with three fossettes, as in *Rhin. tichorhinus* (*op. cit.* Pl. VI. fig. 4).

The presence or absence of the posterior or third fossette entails an important difference in the form of the crown of the last molar. When present (*vide* the fig. last cited), the outline of the tooth is still four-sided, although the posterior side is considerably reduced in width, and the separation of the hind barrel from the end of the outer colline is distinctly marked by an intervening fissure. But when the posterior valley is wanting, the outline of the crown becomes triangular; the summit of the anterior transverse colline remains as usual, while the outer colline is directed diagonally inwards and backwards, so as to make an acute angle with the former. The result is that the summit of the crown, instead of being rectangular, is V-shaped, and the posterior transverse colline

is confluent with and undistinguishable from the outer colline, except by the offset of the crochet, and by the round or barrel-shaped termination at the posterior inner angle. Not a vestige even remains of the posterior outer angle. In fact, the hind leg of the V is composed along two-thirds of its length of the outer colline, the remaining third being made up of the posterior transverse colline, with no mark of demarcation between them. No trace of a depression or groove, corresponding with the posterior fossette, is left upon the surface of the enamel. These characters are well shown by the accompanying figures in Pl. XVIII. fig. 7, representing the summit of the crown in plan, and fig. 6, the same from the inner side, in a germ of the last true molar, left upper, of *Rhin. bicornis*, drawn two-thirds of the natural size: (*a*) indicates the anterior colline; (*b*), the longitudinal colline; (*c*), the continuation of the latter, which is the homologue of the posterior transverse colline; (*d*), the crochet; (*e*), the anterior barrel; (*f*), the anterior basal bourrelet; (*g*), the posterior barrel; (*h*), a small tubercle at the posterior inner angle; and (*i*), the vertical groove of the anterior outer angle.

Let us now examine this tooth as it occurs in *Rhin. hemitœchus*. Figs. 3 and 4 of Pl. XVII. represent top and side views of three-fourths of the natural size of an intact germ of the left last molar, corresponding with the figs. 7 and 6 of Pl. XVIII. of *Rhin. bicornis*; and fig. 5, Pl. XVII., gives an erect view of the outer surface. The same letters of indication apply to the different parts. The outline of the crown in plan is triangular, exactly as in the *Rhin. bicornis*; and the ridges (*a* and *b*) meet at an acute angle, yielding the same V-shaped pattern, the outer and the posterior ridges (*b* and *c*) being continued in the same line without interruption; the anterior basal bourrelet (*f*) repeats the form presented in fig. 7, Pl. XVIII., but is more salient. The crochet (*d*) is projected farther forwards across the valley, and when the erect figure, Pl. XVII. fig. 4, is compared with Pl. XVIII. fig. 6, it is apparent that in the former the crochet makes a more acute angle with the posterior barrel. The niche of the anterior outer angle (*a*) is more pronounced, and there is an intercolumnar tubercle (*k*) at the mouth of the valley which is not seen in the African species. This tubercle is also present in m. 3 of fig. 2, Pl. XVI., and strongly developed in the detached specimen, fig. 5, Pl. XVIII., but wanting in m. 3 of fig. 1, Pl. XVI. On the whole there is a very strong general agreement in form between the last true molars of *Rhin. bicornis* and *Rhin. hemitœchus*; the most obvious difference being the considerably greater dimensions of the tooth in the latter.

The transverse valley in *Rhin. hemitœchus* is triangular at

its commencement, as in the penultimate, m. 2 of fig. 1, Pl. XVI., and is then reduced to a narrow cleft by the projection of the free end of the crochet close to the anterior barrel. The continuation of the valley, beyond the crochet, forms an oblong and somewhat angular expansion, rising from the bottom of which a line of denticular points is seen, connected into a plate attached to the outer colline. This 'combing plate' is projected forwards parallel to the crochet, repeating the pattern already described in p.m. 4, m. 1, and m. 2 of fig. 1, and in m. 2 of fig. 3, Pl. XVI. A similar disposition of these denticular points is exhibited in m. 3 of fig. 1 of Pl. XVI. When the crown is ground down by use, the effect is to produce the appearance presented by m. 3 in fig. 2, Pl. XVI. of a double crochet projected across the valley, one of the processes representing the ordinary crochet, and the other the 'combing plate.' The constancy of this character in running through the whole of the molars proves its importance as a mark of specific distinction.

In some cases, the worn pattern of the middle valley is still more complex. A fine example of this is presented by the last true molar of the specimen No. 22,020 of the Palæontological Catalogue, British Museum, purchased of the late Mr. Ball, and reported to have been procured from the fluviatile deposits of the Valley of the Thames. The five posterior molars of the right side are presented in sequence, the last being in full wear; and in this tooth, besides the crochet and 'parallel combing plate,' the termination of the middle valley presents two additional processes; namely, a stout plate projected at right angles to the crochet, from the anterior outer angle, and a short plate emitted from the anterior colline, above the crochet, and directed backwards. The valley, in consequence, presents a pattern of extreme complexity, with plates jutting into it from three sides.[1]

In *Rhin. bicornis*, Pl. XVIII. fig. 7, the valley is of a similar form, but its posterior wall is free from any combing plate, or tendency to a double crochet. In *Rhin. megarhinus* the crochet of the last molar is also single, and emitted at an open angle from the posterior colline. In illustration, fig. 9 of De Christol's plate, and figs. 6 and 7 of Pl. II. of Gervais' Paléont. Franc. may be referred to.

An abnormal condition of the crochet in the last molar of

[1] The specimen here referred to is described in detail in Dr. Falconer's Notebook as '*R. hemitœchus* of Grays Thurrock,' under date Oct. 1858. Even then he noted important differences in the crochet, &c. from the Minchin Hole Molars; and in his letters to M. Lartet and Col. Wood in 1862 (see pages 309 and 310), he includes the Grays Thurrock Rhinoceros under *R. leptorhinus* (*R. megarhinus*). From some of his later notes, however, it would appear that he identified *R. hemitœchus* as also occurring in the lower brick-earths of Grays Thurrock.—[Ed.]

DESCRIPTION OF PLATE XVIII.

Rhinoceros leptorhinus (R. megarhinus), Rhinoceros hemitœchus, and Rhinoceros bicornis.

Figs. 1 and 2. Represent the two varieties of the last upper premolar, right side, of *Rhinoceros leptorhinus* (*R. megarhinus*, Christ.), referred to at page 328 of the text, in one of which (fig. 1) there is a very pronounced basal bourrelet, while the other (fig. 2) is entirely free from it. These two figures have been copied from the illustrations of De Christol's memoir in the Ann. des Sc. Nat. 2me. Sér. tom. vi. Zool. Pl. III., figs. 10 and 4. In both, the 'combing plate' (R) is seen converging diagonally to meet the plane of the crochet (T) nearly at a right angle. The drawings are about two-thirds of the natural size.

Fig. 3. Represents the penultimate true molar, upper jaw, right side, of *Rhinoceros leptorhinus* (*R. megarhinus*, Christ.), two-thirds of the natural size. The section of the crochet is wedge-shaped, thinning from a broad base to a sharp edge, and it forms a very open angle with the disc of the posterior colline. This specimen is referred to at page 331, and the figure has been copied from Plate III., fig. 3 (not fig. 5, as stated in text), of De Christol's memoir above referred to.

Fig. 4. Penultimate upper molar, left side, of *R. leptorhinus* (*R. megarhinus*), yielding precisely the same characters as fig. 3. It is about two-thirds of the natural size and has been copied from the 'Paléontologie Française,' by Gervais, Pl. II., fig. 5. It is referred to at page 331.

Fig. 5. Last upper molar of *Rhinoceros hemitœchus*, two-thirds of the natural size, showing an abnormal condition of the crochet. The specimen is believed to have been procured from Grays Thurrock, and is now in the Museum of the College of Surgeons. Dr. Falconer's reasons for regarding this tooth as belonging to *R. hemitœchus*, rather than to *R. leptorhinus*, will be found at page 337.

Figs. 6 and 7. Two views of a germ of last upper molar, left side, of the existing species, *Rhinoceros bicornis*, two-thirds of the natural size. Fig. 6, inner side. Fig. 7, crown. *a*, anterior colline; *b*, longitudinal colline; *c*, continuation of longitudinal colline, which is the homologue of the posterior transverse colline; *d*, the crochet; *e*, anterior barrel; *f*, anterior basal bourrelet; *g*, posterior barrel; *h*, small tubercle at posterior inner angle; *i*, the vertical groove of the anterior outer angle. (See page 335.) The specimen is now in the British Museum.

Fig. 1.

Fig. 2.

Fig. 3.

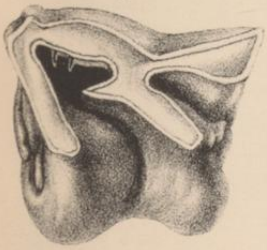


Fig. 4.

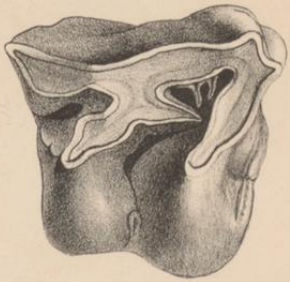


Fig. 5.

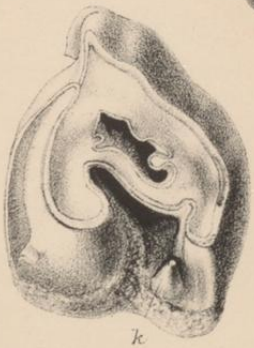
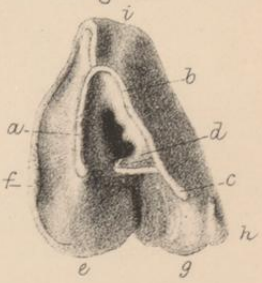


Fig. 6.

Fig. 7.



J. Dinkel del. et lith. 1,2,3,4. Rhinoceros leptorhinus (R. megarhinus) W. West imp.

5. Rhinoceros hemitœchus. 6,7. Rhinoceros bicornis.

Rhin. hemitœchus is presented by a specimen in the Museum of the College of Surgeons, of which the precise origin has not been recorded, but which is believed to have been procured from Grays Thurrock, or some other of the fluviatile deposits in the Valley of the Thames. It is represented two-thirds of the natural size by fig. 5 of Pl. XVIII. In this case the crochet forms a wall across the valley, insulating its upper portion and connecting the two barrels. It is united to the middle of the anterior colline, and above it, a parallel, short, stout, 'combing plate' juts into the insulated fossette. The general form, angular offset of the crochet, enormous coat of cement, and details of the characters prove it to be of *Rhin. hemitœchus*.[1]

That this peculiar confluence of the crochet with the anterior barrel is abnormal in the true molar is proved by the extreme rarity of the instances which have been observed of it in any species of *Rhinoceros*. Cuvier has figured one (Oss. Foss. *Rhinoc.* Pl. XIII. fig. 4), a penultimate, being the Crozes specimen already referred to (*supra*, p. 330). I have examined, in the Museum of the Faculty of Sciences of Montpellier, other specimens from the Département du Gard, which agreed with the figure of this specimen in every essential respect except the irregular connections of the crochet, and they appeared to me all to belong to the *Rhin. megarhinus* of Montpellier. If the form of the crochet, its offset, and the acute angle which it makes with the posterior colline in m. 2 of fig. 2, Plate XVI., are compared with the same points in the Crozes specimen, the differences are very obvious. No other instance of a bridge-crochet in a true molar has, so far as I am aware, been figured. In the milk molar it is by no means of rare occurrence, and is often seen in those of *Rhin. bicornis*. This appearance must not be confounded with the cohesion between the crochet and the 'combing plate,' which gives rise to the third fossette so characteristic of *Rhin. tichorhinus*.

The most significant peculiarity in the last true molar of *Rhin. hemitœchus* remains to be described. From the marked triangular outline of the crown in plan, and the V-shaped confluence of the terminal ridges, it might have been expected that the posterior fossette would be entirely suppressed, as in *Rhin. bicornis* and other species in the same category. But at the posterior angle of the hind barrel, and dislocated from its ordinary position in the other true molars, a well-defined fossette is placed close to the base of the crown. It is of a triangular form, with a gaping rim, which is deeply

[1] On the drawing of this specimen Dr. F. has written '*R. megarhinus*?'—[Ed.]

emarginated behind, and it repeats, but with reduced dimensions, the usual posterior fossette of the penultimate m. 2 of Fig. 1, Plate XVI. The form of this fossette is exhibited by figs. 3 and 4, *h*, and its relation to the other parts by the external view, fig. 5, *h*, of Plate XVII., where a shallow and indistinctly defined channel, bounded on either side by a ridge, is continued upwards upon the enamel-surface from the basal fossette to the apex of the crown, but becoming more and more indistinct as it ascends. This channel is the homologue of the posterior fissure (Oss. Foss., *Rhin.*, Plate VI. fig. 4) in the last molar of *Rhin. tichorhinus* and *Rhin. simus*. On the opposite side of the same figure (fig. 5, *i*) a vertical groove is seen descending from the anterior outer notch. In the last molar of *Rhin. bicornis* (Plate XVIII. fig. 7), the small tubercle (*h*) is the abortive representation of the rim of the posterior fissure of fig. 3, *h*, of Plate XVII.

In consequence of the basal position of the cup of the posterior fissure in the last molar of *Rhin. hemitœchus*, the abrasion of the crown cannot reach it so as to form an insulated fossette till the last stage of use, and ordinarily it is enwrapped by the very thick layer of cement, so as to be only indicated by a protuberant gibbosity, as is seen in m. 3 of fig. 2, Plate XVI., and less distinctly in m. 3 of fig. 1 of the same Plate. The channel, which is continued upwards from the cup, remains usually inconspicuous.

The last true molar, therefore, in the Gower species exhibits the remarkable combination of the following characters: namely, a triangular crown with a V-shaped summit, and two fossettes; one corresponding to the middle valley, the other to the posterior fissure; the posterior barrel narrow and compressed, and giving off a double crochet. In its systematic relations it occupies an intermediate position between *Rhin. bicornis* and *Rhin. tichorhinus*.

In the description of all the molars, reference has been made to the thick layer of cement. This dental constituent is present in greater or less quantity on the teeth of all the species of Rhinoceros. But in *Rhin. hemitœchus* the mass of the layer is so great as to become a character of specific importance. The proportion which it bears to the shell of enamel is best seen on the anterior barrel of m. 2 of fig. 1, Plate XVII. It is there partly denuded, and the enamel looks as if set in a casing of cement. In Fig. 2, Plate XVI., all the molars are completely enveloped by an enormous coat of cement, through which the edging of enamel protrudes. It is also most abundant in all the molars of Fig. 1, Plate XVI. In the last true molar of Fig. 2, Plate XVI., the cement is seen to form a thick layer, insinuated between the

plates of the double crochet and lining the walls of the valley. I have ascertained that it is equally abundant in all the molars of this species from the caves of Oreston and Durdham Down, and from the fluviatile deposits of Clacton, and other similar localities. In the teeth of existing species, such as *Rhin. bicornis* and *Rhin. simus*, the coat of cement cracks and dislaminates, by long exposure to the weather. This accident will account for its absence in certain teeth of *Rhin. hemitœchus*, in which the cement had probably disappeared from weathering before they were embedded in the matrix. When the matrix is a calcareous paste, the layer of cement is apt to be detached from the enamel along with it, as appears to have happened to the external surface of the molars in the Bacon Hole specimen, figs. 1 and 2, Plate XVII. The shell of enamel is very much thinner, in proportion to the other dental elements in this species, than in *Rhin. tichorhinus*. In the latter the external surface is very rugous, while in the former it is comparatively smooth. The difference is so considerable that in many instances the teeth of the two species can be distinguished by this character alone.

De Christol has directed attention to the fact, that in genera of the same families, the older forms have a less coating of cement on their teeth than the newer types. Thus, in *Hipparion*, the layer is much thinner in proportion than in species of the genus *Equus*, and in *Aceratherium* than in *Rhinoceros*. The same difference applies to the Miocene species of Rhinoceros as compared with the modern forms. He has ingeniously attempted to give a general expression to the observation, designating the older forms *Acementodontes*, and the newer *Cementodontes*. Without accepting the generalization as universally applicable, it is worthy of remark that cement abounds on the teeth of *Rhin. tichorhinus* and *Rhin. simus*, and in the extinct form *Rhin. hemitœchus*, while it is comparatively scanty in the teeth of *Rhin. megarhinus* and in specimens attributable to *Rhin. leptorhinus*.

Inferior Molars.—The molars of the lower jaw, in all the species of Rhinoceros, present fewer and less appreciable modifications of the general form than the upper; and they are in consequence of less avail in the distinction of the species. For this reason, they would have been described, on the present occasion, with much more briefness than the upper, but for the fact that the materials for instituting a comparison between *R. leptorhinus* and *R. hemitœchus* are much more abundant, in the shape of lower jaws and teeth, than of upper. Cuvier, having omitted to pay sufficient attention to the character of the upper molars in *R. leptorhinus*, during his journey

in Italy, left it as a behest to the naturalists of that country, to supply the deficiency. But nothing adequate to the demands of the subject has as yet been accomplished by them, and there is hardly extant a single good figure or description of an authentic upper molar of that form, to serve as a standard of comparison; while of lower jaws, besides the figures in the 'Ossemens Fossiles,' there exist in the Palæontological series of the British Museum several fragments containing teeth, from the Val d'Arno, furnishing the desired means in so far as the mandible is concerned.

Figs. 1 and 2 of Pl. XIX. represent the greater portion of the horizontal ramus of the lower jaw, left side, of *R. hemitœchus*, containing the full series usually seen in the adult, of six molars. The crowns are in the stage of wear best suited to show all the characters, the last true molar, although abraded, having the divisions distinct. The specimen belongs to the Swansea Museum. Figs. 1 and 2 of Pl. XX. represent a fragment of a left ramus of equal extent, showing the five last molars *in situ*, and the empty alveolus of the antepenultimate premolar. The wear of the crowns had advanced so far in this specimen, that the four anterior teeth are ground down each to a uniform disc of ivory. Both specimens are from Minchin Hole, and belong to the collection of Colonel Wood.

Fig. 1 of Pl. XXI. represents a mutilated right ramus of the lower jaw, exhibiting also the six posterior molars *in situ*, together with a portion of the symphysial expansion. The specimen is remarkable, in showing the abnormal condition of two collateral teeth, for the last premolar. The crowns are seen in the early stage of abrasion of the adult animal. The specimen, discovered in 'Bacon Hole,' was presented to the Swansea Museum by Colonel Wood. Its dimensions are:—

Extreme length of 6 molars (very nearly), 10·0 in. Ditto of last three molars (to base), 5·97 in. Ditto of 3 anterior ditto, 4·0 in. Ditto of summit of crown last molar, inner side, from edge to edge of enamel, 1·8 in. Ditto of crown near base, 2·18 in. Ditto of penultimate crown, 1·95 in. Width of ditto behind, 1·25 in. Width of ditto in front, 1· in. Extreme width of last molar, 1·3 in. Extreme length of fragment, 12·5 in. Height of jaw inside, behind last molar, 4· in. Ditto in front of last premolar, 3·1 in. Length of summit of antepenultimate true molar (first), 1·7 in. Width of ditto behind, 1·2 in.

The first character that strikes the eye in the teeth of all the three specimens is the very thick layer of cement. In Pl. XX. the last true molar is completely encased in it; while the other teeth are more or less denuded, they show by the fractured edging that this has arisen from accident. The same appearance is presented by the molars of Pl. XIX., which are still more bared. The layer of cement, therefore,

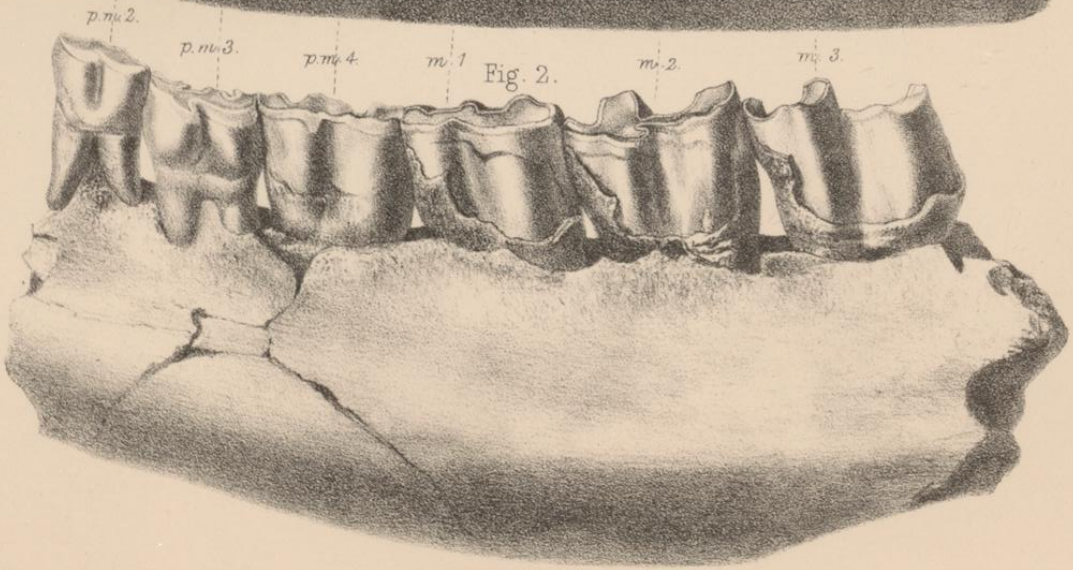
DESCRIPTION OF PLATE XIX.

Rhinoceros hemitœchus.

Figs. 1 and 2. Represent in plan and profile the greater portion of the horizontal ramus of the lower jaw, left side, containing the full series of six molars usually seen in the adult, in the stage of wear best suited to show all the characters. The specimen was found in Minchin Hole by Colonel Wood. The figures are one-half of the natural size, and have been copied from drawings of the original specimens executed for Dr. Falconer by Mr. Dinkel. (See page 340, *et seq.*)

Fig. 1.

Fig. 2.



J. Dinkel del. et lith.

Rhinoceros hemitoechus.

W. West. imp.

DESCRIPTION OF PLATE XX.

Rhinoceros hemitœchus.

Figs. 1 and 2. Represent in plan and profile the greater portion of the horizontal ramus of the lower jaw, left side, showing the five last molars *in situ*, and the empty alveolus of the antepenultimate premolar. The teeth are much further advanced in wear than in the specimen shown in Plate XIX. The specimen was found in 'Minchin Hole' by Colonel Wood, and the figures, one-half of the natural size, have been copied from drawings executed for Dr. Falconer by Mr. Dinkel. (See page 340, *et seq.*)

Fig. 1.

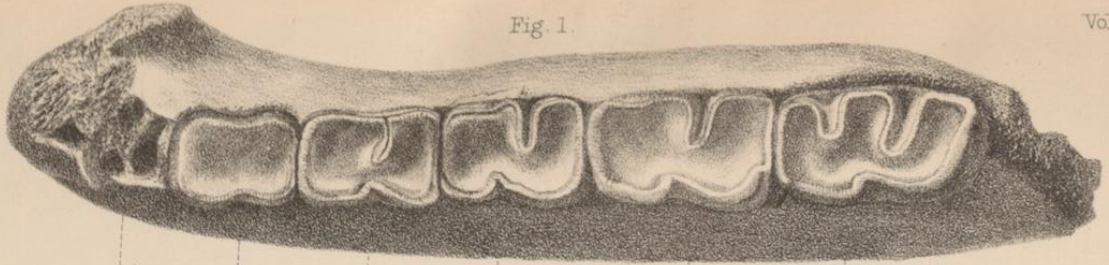
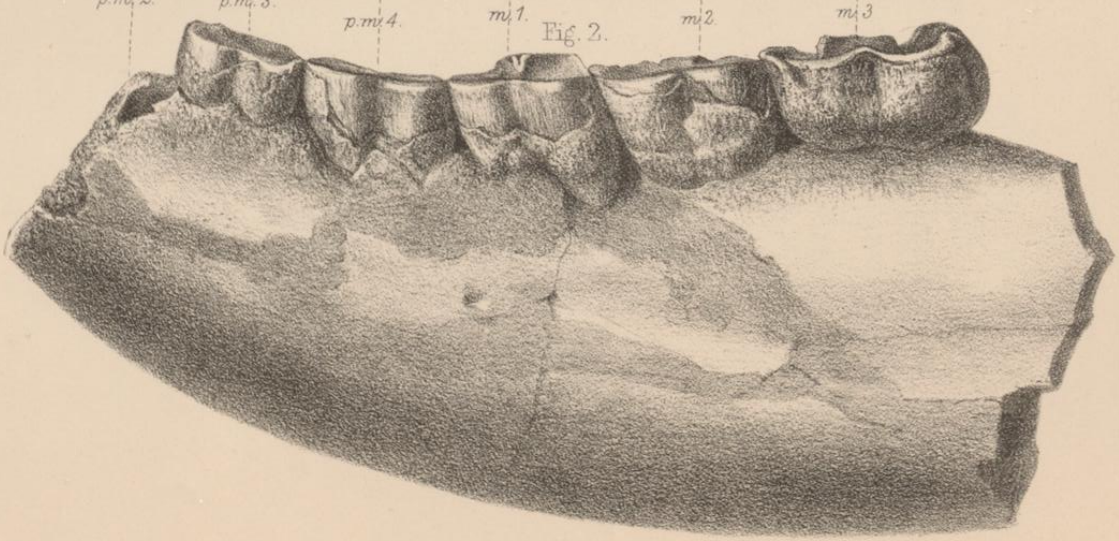


Fig. 2.



J. Dinkel del. et lith.

Rhinoceros hemitœchus.

W. West, imp.

is present alike in the upper and lower molars in very great thickness.

Another character, equally obvious, is the very considerable amount of concavity in the common grinding surface of the teeth, in the antero-posterior direction, from the antepenultimate premolar to the last true molar. This concavity is much more pronounced than in the jaw of either *R. tichorhinus* or *R. megarhinus*, with which I have compared it; and that it is constant in *R. hemitœchus* is proved by its uniformity in the three jaws having teeth in different stages of wear.

Premolars.—The premolars agree very closely in form with those of *R. megarhinus*, the principal difference being in the proportion which their aggregate length bears to that of the true molars. The antepenultimate (p.m. 2 of Pl. XIX.), in horizontal section, is somewhat wedge-shaped, contracting from behind forwards to a narrow edge, which is bent inwards. Its outer surface shows the vertical groove of division between the two crescents, and on the inner side behind there is a well-marked niche indicating the concavity of the posterior crescent. In *R. megarhinus*, the antepenultimate in the same stage of wear is free from any corresponding indentation. The anterior edge in the Gower specimen forms a convex projection. The tooth agrees in the closest manner with the Clacton tooth figured in the 'British Fossil Mammalia,' Cut 136, p. 363, and there referred to *R. leptorhinus*. In the 'Bacon Hole' specimen (fig. 1, Pl. XXI.) the antepenultimate premolar repeats the form presented by p.m. 2 of Pl. XIX.

The penultimate (p.m. 3 of Pl. XIX.) has the crown ground down to a common sinuous disc. The indentation between the two crescents forms on the outer surface a deep niche directed forwards. The remains of the hollows of the crescents on the inner side show that they were deep and boldly defined. The crown of this tooth in *R. hemitœchus* is considerably smaller, both in the actual dimensions and relatively to the last premolar, than in *R. megarhinus* (*vide* Gervais, 'Paléontologie Française' (Pl. II. fig. 8).

The last premolar (p.m. 4 Pl. XIX.) presents an oblong crown, with two boldly pronounced crescents, which are nearly of equal size. It is also very much larger in all its proportions than the tooth which precedes it. Compared with the corresponding premolar of *R. megarhinus*, the following points of difference are observable:—

1st. That the crown is much longer in relation to the antepenultimate, and shorter in relation to the first true molar, than in *R. megarhinus*.

2nd. That the anterior horn of the front crescent is much

more developed and more nearly of the size of the posterior horn, in *R. hemitœchus* than in *R. megarhinus*.

As regards the first of these characters, the penultimate and last premolars in the latter species are nearly of equal size; while in *R. hemitœchus* there is a progressive increase in length of crown from the antepenultimate to the last. The difference is shown by the subjoined comparative measurements.

	Swansea lower jaw, R. hemitœchus	Owen's Clacton, Cat. Br. Fos. Mam., p. 361	Gervais, R. megarhinus	No. 19,840 B. M.	Gunn's R. leptorhinus? (R. Etruscus. —Ed.)	Layton's lower jaw, R. Etruscus	Vald'Arno No. 28,802 B. M. Cat.
Length of 6 last molars .	10·	—	10·5	—	—	—	—
Length of space occupied by 5 last molars . .	8·8	8·8	9·3	8·5	8·15	—	—
Length of 4 last molars (1, 2, 3 m., and 4 p.m.) .	—	—	7·7	7·8	6·6	—	6·4
Length of 3 last molars .	6·	—	6·	—	5·3	—	5·1
Length of 2 last molars .	—	4·2	4·2	—	—	—	—
Joint length of 1st and 2nd true molars . . .	—	—	4·	—	3·4	3·3	—
Length of 3 premolars .	4·	—	4·5	—	—	—	—
Length of last true molar, over crown top . .	2·8	2·2	2·2	2·1	1·75	—	1·9
Length of ditto, base .	2·2	—	—	2·2	1·8	—	—
Width of ditto, behind .	1·3	1·4	—	1·3	1·1	—	—
Length of penultimate, do.	1·95	2·1	2·	2·1	1·85	1·8	—
Width of do., behind	1·25	1·6	—	1·3	1·15	—	—
Width of do., in front at base of crown . .	1·	—	—	—	1·2	—	—
Length of antepenultimate	1·7	—	—	1·9	1·5	—	—
Width of do., behind	1·2	—	—	—	1·15	—	—
Do. of do., in front	1·1	—	—	—	1·1	—	—
Length of last premolar	—	—	—	1·6	—	—	—
Do. of penultimate do.	—	—	—	1·4	—	—	—
Length of diasteme to incisive border . .	—	—	4·4	—	—	—	—
Height of jaw behind last molar, inside . .	4·	4·8	—	4·	3·9	—	—
Height of jaw in front of antepenultimate . .	3·5	—	—	—	3·35	—	—
Height of jaw to alveolar marg. at middle of inner side of p.m. 3 . .	—	3·5	—	—	—	—	—
Extreme thickness under last molar . . .	2·25	—	—	—	2·3	—	—

The second character is well exhibited, on comparing fig. 8 of Pl. II. of Gervais' 'Paléontologie' with Pl. XIX., annexed. In the former the anterior horn of the crescent, in p.m. 3 and 4, and in m. 2 and 3, forms an insignificant lobe, indicated by the anterior niche on the inner side of each of these teeth; while in p.m. 3 and 4, and in m. 2 and m. 3 of Pl. XIX. of *R. hemitœchus* the anterior horn of the crescent makes as large a sweep as the posterior horn. The

DESCRIPTION OF PLATE XXI.

Rhinoceros hemitœchus.

Fig. 1. Represents a mutilated right ramus of the lower jaw, exhibiting the six posterior molars *in situ*, together with a portion of the symphysial expansion. The specimen is remarkable in showing the abnormal condition of two collateral teeth for the last premolar. The crowns are seen in the early stage of abrasion of the adult animal. The specimen was discovered in 'Bacon Hole,' and was presented to the Swansea Museum by Colonel Wood. The figure is about one-half of the natural size and has been copied from a drawing belonging to Mr. Spence Bate. (See pages 340 & 349.)

Figs. 2 and 3. Represent two views in profile and plan, of a fragment of the right upper maxilla with the milk dentition. The first, second, and third milk molars are *in situ*, and part of the alveolus of the fourth milk tooth is also seen. The specimen is among Colonel Wood's collections from the Gower caves, and is believed to have been found in 'Minchin Hole.' The figures are about two-thirds of the natural size, and have been copied from drawings executed for Dr. Falconer by Mr. Dinkel. (See page 353.) Dr. Falconer was struck with the resemblance which this specimen presents to a cast of the dentition of *Rhinoceros Lunellensis*, sent to him by M. Gervais, and now deposited in the British Museum. (See page 309.)

Fig. 1.

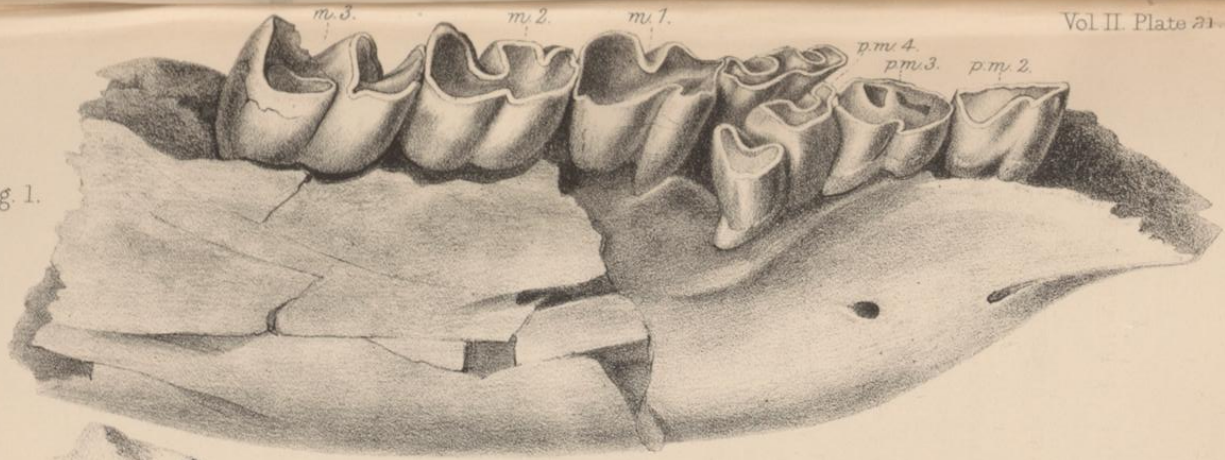


Fig. 2.

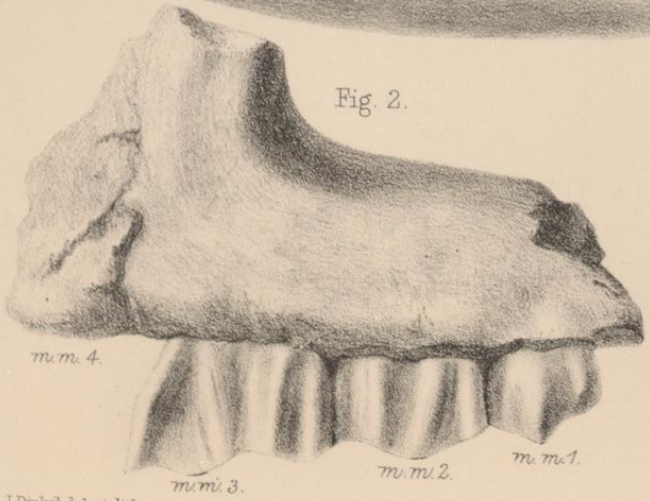


Fig. 3.

J.Dinkel del. et lith.

Rhinoceros hemitœchus

W.West imp.

common consent of palæontologists has pronounced against the value of distinctive characters, derived from the lower molars in the genus Rhinoceros; but the differences above indicated are so constant and well marked, that I regard them as being of specific importance.

In the 'Bacon Hole' specimen (fig. 1, Pl. XXI.), there are two points connected with the premolars deserving notice. In the penultimate (p.m. 3), the crown of which is well worn, a distinct fossette is seen. This is unusual, and has been caused in the present instance by the solution of a portion of the valley between the horns of the posterior crescent. The second point is that the last premolar is double, and represented by two collateral teeth, the outer of which is at a slightly lower level than the inner. The abrasion of the crowns of both these teeth, in relation to that of the penultimate premolar in front, and of the first true molar behind, proves that they are both of the second set, and not a permanent premolar protruded excentrically alongside of a retained milk molar.

True Molars.—The antepenultimate true molar (m. 1 of Pl. XIX.) shows the remains of two well-marked crescents, but being considerably worn it yields no distinctive characters. The crown is oblong, shorter than that of the penultimate. Compared with the corresponding tooth of *R. megarhinus* (Gervais, *op. cit.* Pl. II. fig. 8), it is narrower, in reference to the length. The penultimate (m. 2) being less worn shows the anterior crescent more pronounced; the posterior crescent takes a very oblique antero-posterior direction, its front lobe terminating near the outer third of the anterior crescent; and it represents but a small degree of curvature. The last true molar (m. 3) is the least worn of the three, the posterior crescent being distinct from and still at a lower level than the anterior crescent. Its anterior division presents a very pronounced horse-shoe pattern, with equal limbs. The posterior division is very oblique in direction, and its worn surface exhibits but a small amount of curve. The crown of this tooth is somewhat longer than that of the penultimate.

The dimensions of the same tooth in the same lower jaw vary not a little, according to the different stages of abrasion. They are all inclined a little forwards, and the length of a slightly abraded crown taken at the summit is less than that near the base. In consequence of difference in measurement, arising from causes like these, authors are not agreed in regard to the relative proportions of the different teeth, more especially the penultimate and last, which are the most significant. Duvernoy positively affirms that in *R. tichor-*

hinus the penultimate true molar is smaller than the last; while in *R. leptorhinus* the last is smaller than the penultimate; the latter species in his view been represented by the Rhinoceros jaws figured by Cuvier, from the Val d'Arno, and by the *R. megarhinus* of Montpellier. Brandt distinctly mentions, on two occasions, that in *R. tichorhinus* the last molar is a little larger than the penultimate. On the other hand, Professor Owen, in the table of comparative measurements between the teeth of *R. leptorhinus* and *R. tichorhinus*, given at p. 364 of the 'British Fossil Mammalia,' makes it appear that in *R. tichorhinus* the last true molar is smaller than the penultimate, the reverse holding with the teeth of the so-called *R. leptorhinus*, with which he compares them. But I entertain grave doubts whether the Cromer specimen, assumed in this instance as an example of *R. tichorhinus*, really belongs to that species. There are strong reasons to believe otherwise. An undoubted specimen of a lower jaw of *R. tichorhinus*,[1] from Lawford, is preserved in the Oxford Museum, in which the last true molar is slightly shorter than the penultimate. The dimensions of these teeth are given in the subjoined table of comparative measurements.

	Lawford	R. hemitœchus	Mr. Gunn's[2]
Length of crown of last molar, at apex .	1·7 in.	1·8 in.	1·75 in.
Length of crown of last molar, below . .	1·8 „	2·2 „	1·8 „
Length of penultimate, below . . .	1·85 in.	1·95 in.	1·85 in.
Length of antepenultimate, below . .	1·68 „	1·7 „	1·5 „

In *R. hemitœchus*, the teeth increase in length, uniformly, although not symmetrically, from the antepenultimate premolar to the last true molar, and the last true molar is ordinarily considerably longer than the penultimate. The relative proportions are best exhibited by the worn crowns of Pl. XX. In *R. megarhinus*, the ratio of the length of the three true molars to the three posterior premolars is as 6 to 4·5: and in *R. hemitœchus* as 6 to 4; the length of the whole series being nearly equal in the two species.

It now remains to compare the teeth of the Gower species with an important series of Rhinoceros remains, occurring in the 'Elephant-Bed' or 'Submarine Forest' of the Norfolk coast, near Happisburgh and Mundesley, which, so far as the evidence goes, constantly present well-marked differences. The most perfect of these consist of rami of the lower jaws with teeth. Upper molars are comparatively rare, and such of them as have been met with have in most instances been dispersed. No considerable fragment of a

[1] See p. 401.—[Ed.]

[2] *R. Etruscus.* See p. 345.—[Ed.]

cranium has yet been observed, nor an upper jaw containing many teeth. The most conclusive description of evidence to determine the species is, therefore, still incomplete. The best examples of these remains are to be seen in the collection of the Rev. James Layton, lately acquired for the British Museum, or that of Mr. R. Fitch of Norwich; and in the valuable collection of the Rev. John Gunn of Irstead.

Figs. 1 and 2 of Pl. XXII. represent a fragment comprising the greater part of the horizontal ramus of the left side of the lower jaw, with the three true molars *in situ*, and the empty alveoli of the three last premolars. The aggregate length of the series of teeth is less in this specimen than in either *Rhin. megarhinus* or *Rhin. hemitœchus*, and the proportions between the teeth are different; the relative length of the antepenultimate, penultimate, and last true molars being in *Rhin. hemitœchus* nearly as 1·7. 1·95, and 2·2, and in the Happisburgh specimen 1·5, 1·85, and 1·8. It belongs to the collection of the Rev. John Gunn at Irstead, and was found in the true Forest-bed, with roots of trees, &c., *in situ*.[1]

Another specimen from the collection of the Rev. James Layton, now in the Palæontological series of the British Museum, Cat. No. 33,326, is a corresponding fragment of the lower jaw left ramus, containing the last premolar, and the antepenultimate and penultimate true molars, together with the anterior fang of the last molar *in situ*. The ramus is mutilated in front through the anterior portior of the penultimate premolar, and behind through the last true molar. It is a trifle smaller in size than the previous specimen, and the teeth are a little more worn; but the form of the jaw and the relative proportions of the teeth correspond closely with those of the latter (Pl. XXII. fig. 3).

There are two fragments of lower jaws in the British Museum, presented by Mr. Pentland, from the Val d'Arno.[2] The one (No. 28,802 MSS. Palæont. Cat.) shows the upper or alveolar portion of the left ramus, containing the last

[1] Mr. Gunn has kindly forwarded to me this specimen, to be drawn by Mr. Dinkel. Affixed to it is a label in Dr. Falconer's handwriting, '*R. leptorhinus*, Cuv.' But as above stated (p. 314), Cuvier included under his *Rhin. leptorhinus* the Rhinoceros of the Val d'Arno, which Dr. Falconer subsequently separated and designated *Rhin. Etruscus*. The Rhinoceros of Messrs. Gunn and Layton's collections was therefore *Rhin. Etruscus*. See pp. 310 and 355.—[Ed.]

[2] Other specimens of the same species in Mr. Pentland's collection are also described in Dr. Falconer's note-books, viz.: No. 28,804, a last or penultimate true molar; No. 33,324, a last milk ? molar, upper jaw, right side; and No. 33,323, a last milk molar, upper jaw, left side. A tibia of Rhinoceros which accompanies these teeth is described as 'much more slender and considerably longer than that of the Clacton species.' The teeth are stated to have been from the Conglomerate *Sansino* of the Val d'Arno, and not from the *Sabbone* or blue clay.—[Ed.]

premolar and the three true molars *in situ*. The antepenultimate true molar is worn low, and the last tooth is well advanced in wear (Pl. XXII. fig. 4). In form, proportions, and size, the teeth agree very closely with those of Mr. Gunn's specimen. The second Val d'Arno specimen (No. 28,803 MSS. Palæont. Cat.) contains the penultimate and last true molars of the left ramus of the lower jaw. In form and size, they are exactly the counterpart of No. 28,802. The following are the comparative dimensions of the teeth in these specimens, contrasted with the same in *Rhin. hemitœchus*.

	Swansea lower jaw of Rh. hemitœchus	Owen's Clacton, Br. Fos. Mam. p. 361	No. 19,840 of Brit. Museum collection	Gervais, Rh. meridionalis	Cast of Rh. megarhinus	Gunn's Rh. leptorhinus (R. Etruscus.—Ed.)	Lawton Rh. leptorhinus (R. Etruscus.—Ed.)	Pentlands' Val d'Arno, 28,802 of British Museum	Fitch's Cromer lower jaw, Owen, pp. 364 & 347	Rh. tichorhinus, Owen, Br. Fos. Mam., Cat. 124
Length of the 6 last molars	10·	—	—	10·5	10·55	—	—	—	—	—
Do. of 5 last molars	8·8	8·8	8·5	9·3	9·3	8·15	—	—	—	—
Do. of 4 last molars	—	—	7·8	7·7	7·7	6·6	—	6·4	—	—
Do. of 3 last molars	6·	—	—	6·	5·15	5·3	—	5·1	—	—
Do. of 2 last molars	—	4·2	—	4·2	4·3	—	—	—	—	—
Do. of 1st and 2nd true molars . .	—	—	—	4·	4·	3·4	3·3	—	—	—
Do. of 3 posterior premolars . . .	4·	—	—	4·5	4·5	—	—	—	—	—
Do. of last true molar	2·2	2·2	2·2	2·2	—	1·8	—	1·9	1·8	1·8
Width of do.	1·3	1·4	1·3	—	—	1·1	—	—	—	—
Length of penultimate do.	1·95	2·1	2·1	2·	—	1·85	1·8	—	1·9	1·85
Width of do.	1·25	1·6	1·3	—	—	1·15	—	—	—	—
Length of antepenultimate do. . . .	1·7	—	1·9	1·9	—	1·5	—	—	—	1·68
Length of last premolar .	—	—	—	—	—	1·6	—	—	—	—

The agreement of the Happisburgh and Tuscan teeth so closely, in size, form, and proportions, excites attention to

their other dental characters. Cuvier, in describing the lower jaws of his species 'à narines non-cloisonées' of Italy, refers to figs. 8 and 9 of Pl. IX., representing Tuscan specimens, in proof that it had seven molars below in the adult state, the pre-antepenultimate or first premolar, which is suppressed in the Siberian Rhinoceros, being developed; and he seized upon this character as a distinctive mark of his *Rhin. leptorhinus*. This pre-antepenultimate, although present in the milk dentition, is suppressed in *Rhin. hemitœchus* in the adult state, and it is also wanting in *Rhin. megarhinus*. Thence, it becomes a point of the highest interest to ascertain, whether it was present or suppressed in the fossil Rhinoceros of the 'Elephant-Bed' of Happisburgh. Professor Owen has described (Brit. Fos. Mam., p. 347) a fine specimen, comprising the greater portion of the horizontal ramus of the lower jaw of a Rhinoceros, procured from the 'Lignite Bed' of Cromer, being an extension of the Happisburgh deposit. In this fragment, which is of a young adult, there were four premolars and three true molars. Of the latter, two are in place, and the last emerging; of the former, the alveoli of the first remain, the two next are in place, and the fourth or last is embedded in the jaw under the last milk molar, which had not yet been shed. A portion of the wall of the jaw has been excised, and the milk tooth is seen superimposed to its successor. The pre-antepenultimate premolar in this case had dropt out, but the fang-pits prove beyond question that it had been there. Professor Owen has selected this specimen as a standard example of *Rhin. tichorhinus*, for comparison with a corresponding jaw of his *Rhin. leptorhinus*, and he has given measurements of the two in contrast. I have seen the specimen in question, in Mr. R. Fitch's collection in Norwich, and both the form of the jaw and the relative proportions of the teeth conveyed to my mind the impression that it belonged neither to *Rhin. tichorhinus* nor to *Rhin. hemitœchus*, but to the same species as the specimens above described, of Messrs. Gunn and Layton, *i.e.* to the 'Rhinoceros à narines non-cloisonées' of Cuvier, from Tuscany. Not having the fragment now before me, I am desirous of expressing this opinion with diffidence and reserve.

Professor Owen was probably influenced, in arriving at the above identification, by the belief that he had established the fact that the first premolar is present in the lower jaw of *Rhin. tichorhinus*, although Cuvier had asserted the contrary. In the 'British Fossil Mammalia' he has given a representation, natural size (fig. 137, p. 363), of the two anterior teeth of a young fossil jaw from Lawford, preserved in the Oxford Museum. These teeth he considers to be pre-

molars, and he contrasts the second with an antepenultimate premolar (fig. 136, *op. cit.*), also natural size, of the Clacton species. The difference both in size and form between the two is assuredly very great, and if the comparison were well founded and sound, it would furnish a strongly marked distinctive character of the species; but it appears to me, that in this case this eminent palæontologist has fallen into the error of comparing the milk tooth of one jaw with the corresponding permanent premolar of another. The Clacton tooth is unquestionably a permanent premolar of the second set; but the Lawford jaw (figs. 128 and 137, *op. cit.*) contains four teeth, presenting as it seems to me the characters of milk molars. Without going, on the present occasion, into the details of the evidence for this conclusion, I may state that I have compared the figure of the pre-antepenultimate (p. 1 of Cut 137, above referred to) with the pre-antepenultimate milk molar of a very young jaw of *Rhin. hemitœchus*, in Col. Wood's collection from 'Minchin Hole,' and found them agree in size and form, to the most minute particulars. Brandt, with access to the rich collections in the Russian Museums, distinctly states, in his monograph on the Siberian Rhinoceros, that he had never seen an adult lower jaw of this species showing more than six molars, thus confirming the early inference of Cuvier. The definite settlement of this point, when well ascertained, will be of much greater importance than merely determining the precise number of inferior molars in an extinct species. Hence the reference to it now. The presence of seven lower molars in the lower jaw from Cromer furnishes of itself, independently of the other evidence, strong grounds, to my mind, in favour of the specimen being referable to the 'Rhinoceros à narines non-cloisonées,' and not to *Rhin. tichorhinus*. It will be a remarkable fact in Geology if it is proved that the latter species was a contemporary of the Sub-Apennine *Elephas meridionalis*, as well as of the Glacial Mammoth.[1]

[1] The above was written in 1860. The Rhinoceros of the Val d'Arno and of the 'Submarine Forest-bed of the Norfolk Coast' was subsequently designated by Dr. Falconer *Rhin. Etruscus*. See pp. 310 and 355.—[Ed.]