A

HISTORY

OF

BRITISH FOSSIL MAMMALS,

AND

BIRDS.

BY

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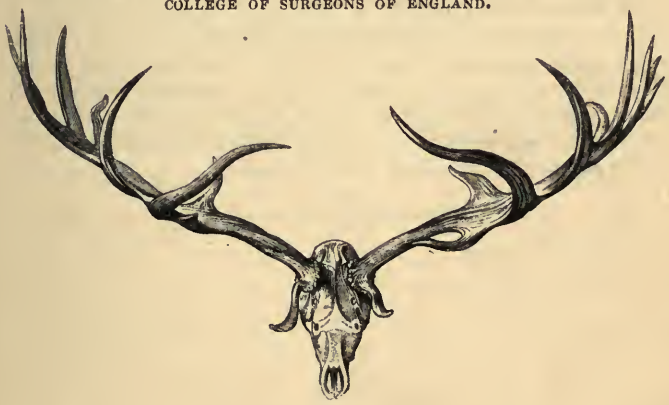
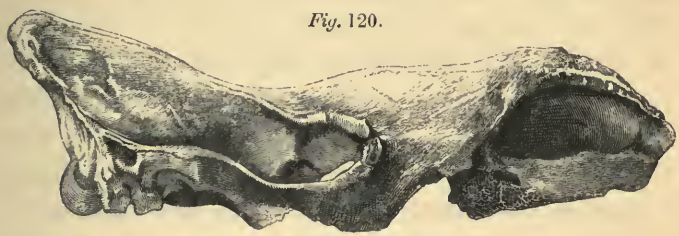


ILLUSTRATED BY 237 WOODCUTS.

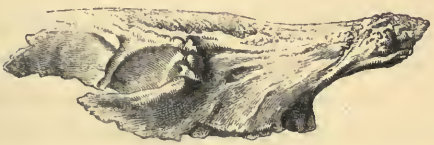
LONDON:
JOHN VAN VOORST, PATERNOSTER ROW.
M.DCCC.XLVI.

Fig. 120.



Skull of Rhinoceros tichorhinus. $\frac{1}{8}$ nat. size.

Fig. 121.



Portion of skull of Rhinoceros, from Newer Pliocene at Chartham, Kent.

RHINOCEROS TICHORHINUS. Tichorhine two-horned Rhinoceros.

Rhinoceros tichorhinus. ou Rh. à narines cloisonnés. Cuvier, Annales du Muséum, tom. iii., p, 46. Ossemens Fossiles, 4to, 1822, vol. ii. pt. i.

The first notice and figure of fossil remains referable to the genus *Rhinoceros*, occurs in a quaint and extremely rare old tract entitled, "Chartham News, or, A Brief Relation of some strange Bones there lately digged up, in some grounds of Mr. John Somner of Canterbury: written by his brother, Mr. William Somner, late auditor of Christ Church, Canterbury, and register of the Archbishop's court there, before his death.—London: Printed for T. Garthwait, 1669." (4to, pp. 10, with a plate.)

"News from Chartham in Kent.—Although it may, and perhaps must be granted, that miracles (strictly understood) are long since ceased; yet in the latitude of the notion, comprehending all things uncouth and strange, (*miranda*, as well as *miracula*; wonders as well as miracles,) they are not so; but do, more or less, somewhere or other dayly exert and shew themselves, *Dies diem docet.*" After a fling at the "New lights that are now-a-days much cried up," and leaving these "spiritual mountebanks and their counterfeit ware,"—a race still far from being extinct,—the worthy 'Register' proceeds "to the matter-of-fact then."

"Mr. John Somner, in the month of September, 1668, sinking a well at a new house of his in Chartham, a village about three miles from Canterbury, towards Ashford, on a shelving ground or bankside, within twelve rods of the river, running from thence to Canterbury and to Sandwich Haven; and, digging for that purpose about seventeen feet deep, through gravelly and chalky ground and two feet into the springs; there met with, took, and turned up a parcel of strange and monstrous bones, some whole, some broken, together with four teeth, perfect and sound, but in a manner petrified and turned into stone, weighing (each tooth) something above half a pound, and almost as big, some of them, as a man's fist."

Alluding to the notices of the remains of giants which were current in the philosophical and other works of the time, the author judiciously remarks:—"And so we must have judged of these teeth and of the body to which they belonged; had not other bones been found with them, which could not be man's bones." "Some that have seen them," he proceeds to say, "by the teeth and some other circumstances, are of opinion, that they are the bones of

an Hippopotamus, or Equus fluvialis, that is, a River-horse; for a Sea-horse, as commonly understood and exhibited, is a fictitious thing. Yet Pliny makes Hippopotamum ('mari, terræ, amni communem,') to belong to sea, land, and rivers. But what are the differences and properties of each kind, I leave others to inquire. The earth, or mould about them, and in which they all lay, *being like a sea-earth or fulling earth* has not a stone in it, unless you dig three feet deeper, and then it rises a perfect gravel."

This last passage gives a more exact knowledge of the matrix of the fossils than is usually found in analogous notices: we readily recognise in it the post-pliocene brick-earth and drift which have since yielded, especially in the counties of Kent, Surrey, and Essex, so rich a harvest of the remains of great extinct Pachyderms.

"So have you the story, an account, if you please, of what was found, where, when, and upon what occasion. For more public satisfaction, and to facilitate the discovery; at least to help such as are minded to employ their skill in guessing and judging of the creature, whose remains these are, what it was for kind; we have by and with the help of an able limner, adventured on a scheme or figure of several of the teeth and bones, with their respective dimensions of breadth, length, and thickness."

"No man, we conceive, not willing to be censured of rashness, will be very forward to divine, much less to define or determine what the creature was; and, doubtless, dubious enough it is, whether of the twain, the sea, or the land, may more rightly lay claim unto it."

Mr. Somner having, nevertheless, "taken a large time of consideration of all particulars and circumstances fit to be duly and deliberately weighed and observed in the case," adventures to conjecture it to be "some sea-bred

creature ;" and then proceeds to discuss at length the question, "How it possibly came there? Piscis in arido?" with its four following branches :—

"1. Whether the situation and condition, face and figure of the place, may possibly admit of the sea's once insinuating itself thither?

"2. Whether (that possibility being granted or evinced) the sea did ever actually insinuate itself so far as to this place, and when?

"3. How, in probability, and when, this valley or level being once sea-land, should come to be so quite deserted and forsaken of the sea, as it is at this day, the sea not approaching by so many, a dozen, miles or more?

"4. By what means the sea, once having its play there, this creature comes to lodge and be found so deep in the ground, and under such a shelving bank?"

Our limits compel us to terminate here the quotations, and to refer the geologist, interested in such early attempts to solve the problems relating to the changes in the earth's surface, to the pamphlet itself, of which a copy exists in the King's Library in the British Museum, or to the reprint of it in the Philosophical Transactions for 1701, No. 272, p. 882.

With the inquiry into the causes of the sea's progress and retreat in Kent, as evidenced by the supposed "sea-bred monster," we have here, in fact, the less concern, since we shall be able to shew that it belonged to a terrestrial genus of quadruped.

The figures of two of its teeth, "part of what the author intended, if he had lived," are so exact, and the progress of Comparative Anatomy since 1668 has been so immense, that they may now be determined, without much laudable ingenuity or blameable rashness, to have

belonged to a Rhinoceros, and to have come from the middle of the molar series of the upper jaw. But we are fortunately enabled to go further, and inquire into the exact species of Rhinoceros to which they belonged: for the identical fossils discovered at Chartham are now preserved in the British Museum. They are noticed by Nehemiah Grew in his 'Catalogue of the Rarities of Gresham College,' p. 254; and were doubtless transferred to their present depository along with the other objects contained in the ancient Museum of the Royal Society.

The annexed cut (fig. 122) is an original figure of the best preserved of the molar teeth from Chartham: it is

Fig. 122.

Upper molar tooth of *Rhinoceros tichorhinus*, Newer Pliocene, Chartham, Kent.

the fifth or sixth molar of the right side. It well exemplifies the close analogy of the molars of the Rhinoceros to those of the Palæotherium (see fig. 110). We perceive the same cubical form of the crown; the grinding

surface of which is similarly broken by a deep valley, (*a*,) extending from the posterior margin nearly half-way across, and by a deeper and longer valley, *b*, commencing from the middle of the inner side of the crown, and expanding and partly dividing into two deep depressions near its opposite extremity. The principal difference by which the upper molars of the Rhinoceros may be distinguished, independently of their greater size, from those of the Palæotherium, is the much inferior depth of the two longitudinal depressions (*d d*) on the outer side of the tooth, and the feeble development of their boundary ridges. In the Palæotherium, a slight rising may be discerned at the bottom of each of the two deep outer pressions (see fig. 112) : this rising is much increased in the Rhinoceros, and gains the level of the borders of the depressions, giving an undulating character to the outer surface of the tooth. The changes produced by age and progressive wearing away of the grinding surface will be illustrated by subsequent specimens.

One of the "strange and monstrous bones" exhumed with the teeth at Chartham (fig. 121), is described by Grew* as "part of the far cheek, with both the ends and the sockets of the teeth broken off." He compares it with the corresponding part of the Hippopotamus ; and, finding "that the orbit of the eye is neither so round nor so big, yet the teeth far bigger;" that the forehead stands higher than the eye, whilst in the Hippopotamus "it lies so low, that it looks like a valley between two hills," he concludes it more likely that it belonged to a Rhinoceros, "for the being whereof in this country we have as much ground to suppose it as of the Hippo-

* Loc. cit., p. 255.

potamus." Of the soundness of Grew's determination, the reader will be able to judge by comparing the figure of the fossil (fig. 121) with that of the entire cranium of the *Rhinoceros tichorhinus*, which is placed above it, at the head of the present section.

Two distinct rough surfaces (*h h*) may be traced on the upper part of the fragment, shewing that the species of Rhinoceros to which it belonged was two-horned; and the anterior surface rises towards its middle part, as if to form the longitudinal ridge, which there characterises the fossil species, and distinguishes it from the African two-horned Rhinoceros, which has a depression at the corresponding part of the skull. But more decisive evidence of the relationship of the Chartham fossil to the extinct *Rhinoceros tichorhinus* is afforded by the remains of the strong and thick bony wall which descended from the bones supporting the horns to form the partition between the two cavities of the nostrils, and give additional strength to that part of the skull.

Cuvier concludes, from this peculiar structure of the most common extinct species of two-horned Rhinoceros of the northern and temperate regions of Asia and Europe, that it bore longer and more formidable nasal weapons than do any of the known existing species with two horns. In the Chartham fossil, a great part of the bony septum is broken away: it remains in the entire skull figured (fig. 120). The skull of the extinct Rhinoceros was relatively longer in proportion, and terminated forwards by a peculiar modification of the nasal bones, which, by the medium of the thickened anterior part of the osseous partition-wall were anchylosed, or joined by a continuous bony mass, with the fore-part of the intermaxillary bones, or those that terminate the upper jaw.

The bony partition-wall, with its peculiar anterior termination,* is well displayed in some of the entire skulls of the tichorhine Rhinoceros, which have been discovered in this country. One of these, figured by Cuvier, 'Ossemens Fossiles,' 4to., 1822, tom. ii., pt. 1., pl. ix., fig. 3, was found in a slate-pit at Stonesfield in Oxfordshire, about four miles from Woodstock. Dr. Buckland possesses fine specimens of the skulls and other bones of the same extinct Rhinoceros, which were discovered, associated with remains of the Mammoth, Hyæna, &c., in the drift on the banks of the Avon, at Lawford, near Rugby.

The most complete skeletons have been found, as might be expected, in caverns or cavernous fissures, where the carcass of the fallen animal has been best protected from external changes and movements of the soil.

Dr. Buckland has recorded one of the most remarkable examples of this kind, which was brought to light in the operation of sinking a shaft through solid mountain limestone (fig. 130, F), in a mining operation for lead-ore near Wirksworth, Derbyshire.† A natural cavern (*ib.* C) was thus laid open, which had become filled to the roof with a confused mass of argillaceous earth and fragments of stone, and had communicated with the surface by a fissure (*ib.* B) fifty-eight feet deep and six feet broad, similarly filled to the top, where the outlet (*ib.* A) had been concealed by the vegetation. Near the bottom of this fissure, but in the midst of the drift (*ib.* D), and raised by many feet of the same material from the floor of the cavern, was found nearly the whole skeleton of a Rhinoceros (*ib.* E), with the bones almost in their natural

* The name imposed by Cuvier on the present extinct species of Rhinoceros has reference to this structure: it is from τεῖχος, a wall, ῥὶν, a nose: *tichorhinus*.

† 'Reliquiæ Diluvianæ,' p. 61.

juxta-position: one part of the skull which was recovered shewed the rough surface for the front horn; the back part of the skull and one half of the under jaw were detached. All the bones were in a state of high preservation. There were no supernumerary bones to indicate the presence of a second Rhinoceros, but a few remains of Ruminants, apparently of extinct species.

The skull of the Rhinoceros, which, with the rest of the bones so fortunately preserved, is now deposited in the Geological Museum at Oxford, shews the bony partition of the nasal cavity characteristic of the *Rhinoceros tichorhinus*, and the lower jaw further illustrates the peculiarities of that extinct species.

As the evidence of a second British extinct species of Rhinoceros will, in the sequel, be established by the characters of the lower jaw, I subjoin two figures of the specimen of that bone from the cave at Wirksworth.

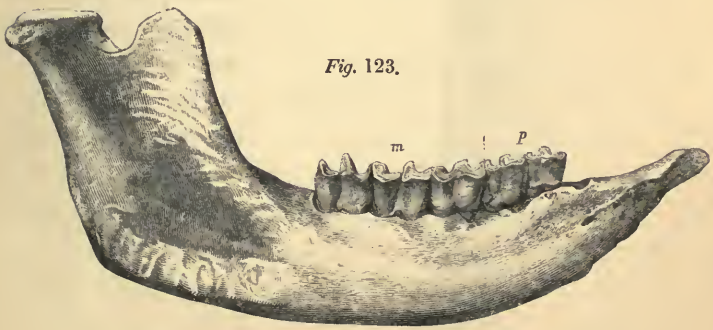


Fig. 123.

Lower jaw of *Rhinoceros tichorhinus*, Cave, Wirksworth. $\frac{1}{8}$ nat. size.

In the side-view of this jaw given above, the extent of the anterior end of the jaw, called the symphysis, in advance of the molar teeth, is shewn: this part is peculiar, in the *Rhinoceros tichorhinus*, both for its length and

its small vertical diameter. Pallas believed that he had found remains of the sockets of incisive teeth in the symphysis, and such traces are shewn by one of the specimens from Rugby, in the Geological Museum at Oxford; a structure, as Cuvier justly remarks, which approximates the *Rhinoceros tichorhinus* to the one-horned Rhinoceros of Asia.

Fig. 124.

Lower jaw of *Rhinoceros tichorhinus*, Cave, Wirksworth. ¼ nat. size.

Fig. 124 shews the breadth of the symphysis, and the grinding surface of the lower molar teeth; but, before adverting to these, I shall notice the chief modifications of form under which the upper molar teeth of the *Rhinoceros tichorhinus* may present themselves.

It has been already observed, * that, in the cave at

* Ante, p. 259.

Kirkdale, the remains of the large herbivorous quadrupeds were chiefly those of young animals, and such as would most easily fall a prey to the Hyænas, and be dragged by them into their den.

Fig. 125 represents the grinding surface of an upper molar tooth of the *Rhinoceros tichorhinus*, which was discovered in the Kirkdale cavern, and is now in the British Museum. This tooth is the third of the series; only the crown had been formed and had not made its appearance above the gum. From its size, it was likewise evidently the germ of a deciduous or milk tooth. The comparison of figure 124, with figure 112, of a similar germ of an upper molar tooth of the *Palæotherium medium*, will illustrate the similarity of plan, and generic modification, of the structure of the teeth of the Rhinoceros, as compared with those of the more ancient Pachyderm. The outer wall of the crown is more even and less deeply indented; the two valleys, *a* and *b*, are wider in the Rhinoceros.

Fig. 125.

Deciduous upper molar; nat. size; *Rhinoceros tichorhinus.* Kirkdale cavern.

Mastication first exposes the dentine at the summits of the ridges, and produces the two peninsular folds of enamel shewn in fig. 122. The continued wear of the tooth next insulates the posterior division of the transverse peninsula and simplifies it, as at *b* in the molar tooth from the cave of Kent's Hole (fig. 126). As the shorter valley (*a*) is deepest at its extremity, further attrition exposes the

dentine at its shallower commencement, and a second island of enamel is produced, as in the molar tooth figured by Cuvier, 'Ossemens Fossils,' 4to., 1822, tom. ii. pt. 1. pl. xiii. fig. 6. In very old Rhinoceroses the first formed island

Fig. 126.

Fourth right upper molar ; nat. size ; *Rhinoceros tichorhinus ;* Cave, Kent's Hole, Torquay.

of enamel, which surrounds the shallowest depression, is worn away, and the grinding surface simplified to the pattern figured by Cuvier in the plate above cited, fig. 5.

The teeth of the lower jaw of the Rhinoceros present the same degree of resemblance to these of the Palæotherium, as exists in the upper jaw. The crown of each molar consists of two vertical crescentic lobes, but these are less regularly curved, are placed more obliquely with regard to each other, and are divided by a deeper cleft. Hence the dentinal substance of the two lobes, when exposed at their

summits by attrition, is not so soon blended into one continuous tract as in the Palæothere (fig. 116), but long remains insulated by a complete boundary ridge of enamel in each lobe, as shown in the lower molar tooth of the *Rhinoceros tichorhinus* (fig. 127). This tooth was discovered in the drift gravel, over-lying the London clay, during the operations of digging the Regent's Canal, and is now in the British Museum. It shows also the deeper internal excavation, and the unequal height of the two crescentic lobes, which distinguish the lower molars of the Rhinoceros from those of the largest Palæothere.

Fig. 127.

Fifth molar, right side, lower jaw, nat. size ; *Rhinoceros tichorhinus.* Drift gravel.

In the lower jaw of the *Rhinoceros tichorhinus*, represented in figures 123 and 124, five molar teeth are shown *in situ*, and the socket of a small premolar in front. The lower jaw, discovered at Montpellier, figured by M. Christol in his Memoir on the species of fossil Rhinoceros, in the 'Annales des Sciences' for 1835, pl. ii. figs. 1 and 2, and referred by that author to the *Rhinoceros tichorhinus*, is described (p. 46) as having all its molars, "munie de toutes ses molaires," of which teeth the figures exhibit six, corresponding in number with those of the specimen from Wirksworth. I have, however, obtained good evidence, from British specimens, of the accuracy of M. Adrien Camper's statement, cited by Cuvier, 'Ossemens Fossiles,' 1822, tom. ii. pt. 1. p. 61, that the tichorhine Rhinoceros had seven molar teeth on each side of the lower jaw, like the existing species; and that the smaller number in the

jaws from Montpellier and Wirksworth, is due to the age of the individuals to which they belonged.

The anterior part of the left branch of the lower jaw of a younger Rhinoceros (fig. 128), from the drift at Lawford, near Rugby, now in Dr. Buckland's Museum, contains four teeth, which demonstrate, by their relative position to the broken symphysis, a distinctive character of the *Rhinoceros tichorhinus*, and, at the same time, the existence of a smaller and more simple premolar anterior to that tooth, of which the empty socket is shown in fig. 124. The third tooth, in the present specimen, precisely accords in size and conformation with the second in fig. 124; and the fourth premolar with the third tooth, in fig. 124: the sole differences which the teeth in the younger specimen present, arise from their having been much more recently acquired; the summits of the two crescents, composing the crown of the third tooth, had only just begun to be used in mastication, whilst those of the fourth are entire, and the base of the crown is not quite disengaged from the socket. We have in this instructive specimen the whole series of premolars, or those permanent teeth which succeed and displace the four deciduous molars of the still younger Rhinoceros. The individual to which the fossil in question belonged, must have perished just as it had accomplished this change of its dentition. In fig. 124, it may be observed that the third tooth in place, which is the first true molar, has been more worn than the tooth in advance, from which it is separated by the dotted line; the summits of the two

Fig. 128.

Portion of lower jaw. ¼ nat. size. *Rhinoceros tichorhinus*. Drift, Lawford, Rugby.

crescents are still distinct in the anterior tooth, whilst in that which follows, they are blended by a continuous tract of dentine. This difference arises from the circumstance that the first true molar comes into place immediately behind the deciduous series of four teeth, before these are shed and succeeded by the four premolars shown in fig. 128; it thus assists in performing the essential work of mastication whilst the change of dentition is going on, and is, consequently, worn down to some extent before the fourth premolar has risen into place.

The first premolar in the *Rhinoceros tichorhinus* has a compressed conical crown, the anterior half simple and subtrenchant, the posterior half broader, and impressed by a vertical pit: it is supported by two connate fangs, implanted in a simple alveolus; the antero-posterior extent of the crown is between seven and eight lines, the height of the enamelled part is half an inch: the socket is on the same transverse line as the posterior border of the symphysis. The form and size of the three succeeding molars may be judged of from the figures in cuts 123, 124, and 128. In the last specimen, the longitudinal extent of the series of four premolars is four inches nine lines. The first premolar appears to be shed, in the *Rhinoceros tichorhinus*, before the last true molar rises completely into place.

Similar evidence of the true number of the molar series in the lower jaw of the *Rhinoceros tichorhinus*, is given by another British specimen, to which historical interest is attached, both from its early introduction to the notice of Geologists, and on account of the opinion respecting it which Cuvier has left on record. The specimen in question is that which Douglas has figured in his 'Dissertation on the Antiquity of the Earth,' 4to, 1785, as the "Fossil *animal incognitum* bone from Thame," and which he notices

in the Appendix, p. 45, as "the specimen in the Museum of Sir Ashton Lever, No. 20, which was found under ground by digging at Thame, in Oxfordshire."

The original, now in the Geological Museum at Oxford, was kindly pointed out to me by Professor Buckland, who has attached to it the following note:—"In 1829 I purchased this specimen at a sale in London, from the Museum of Mr. Donovan, who probably purchased it at the sale of the Leverian Museum." The extract from the 'Ossemens Fossiles,' 1822, vol. ii. p. 54, is added, as follows. "*Douglas* (loc. cit. App. p. 45,) représente un fragment de mâchoire inférieure contenant trois dents, trouvé en creusant un puits, à *Thame*, dans le comté *d'Oxford*, et conservé alors dans le Musée de *Lever*. Il paroit de l'espèce de Lombardie à narines non cloisonnées."

The distinctive characters of the lower jaw of the species of extinct *Rhinoceros*, called by Cuvier 'non-cloisonné or *leptorhinus*,' are very clearly illustrated by the figures of the Lombardy specimens, which he has given in pl. ix. figs. 8 and 9 of the volume cited, and by the English fossils described and figured in the succeeding section. The lower jaw from Thame manifests as clearly, by the position of the first premolar behind the symphysis, its specific identity with the *Rhinoceros tichorhinus*, and it so closely agrees with the specimen from Lawford (fig. 128), as to render a figure of it unnecessary in this work.

In that which Douglas has given of the natural size, viewed from the inside (the mirror not employed), the second premolar, which was then in place, is behind the symphysis, and the small, partially divided socket for the first premolar has the same relative position to the posterior border of the symphysis as in the lower jaw (fig. 128). Douglas's specimen belonged to an immature

Rhinoceros of nearly the same age as that from Lawford; the summit of the second crescent of the fourth premolar shows that it had just come into use at the period when the animal perished. The anterior of the three ridges, on the inner side of the crown of the third and fourth premolars, supports a small oblong tubercle,* a variety not present in the Lawford specimen. In the *Rhinoceros leptorhinus* of the fresh-water deposits in Lombardy, a species also co-existing of old with the tichorhine Rhinoceros in Britain, the premolar teeth extend forwards much closer to the anterior end of the jaw, and the second premolar is placed in advance of the posterior border of the symphysis (see figs. 132 and 134).

The portion of lower jaw, with two molar teeth, which forms the subject of the first plate in Douglas's 'Dissertation,' and the foundation of much ingenious reasoning, on the supposition that it was part of a Hippopotamus, belongs to a Rhinoceros, and probably to the extinct tichorhine species. It was discovered in "a stratum of drift or river sand, blended with a kind of clay, of a yellowish grey tinge," at the depth of twelve feet, in dig-

* Cuvier, in detailing the discovery at Avary of certain fossils, which he refers to the *Rhinoceros incisivus*, says, "Enfin une dent inférieure, plus usée, est peut-être la cinquième ou la sixième; j'y vois, au deuxième croissant du côté interne, un crochet que je ne retrouve pas dans les autres espèces." 'Ossemens Fossiles,' 1822, tom. iii. p. 391. M. Christol, believing that he had discovered this character in the molars of the lower jaw of the *Rhinoceros tichorhinus*, regards it as distinctive of that species. 'Annales des Sciences,' 1835, tom. iv. p. 62. In the lower molar tooth, which he figures to illustrate this character, it is shown as a minute notch near the upper and posterior part of the middle ridge on the inner side of the crown, which ridge is formed by the posterior and inner termination of the first or anterior crescent; the notch cuts that ridge in a direction downwards and forwards, detaching from it a small conical process. I cannot find a trace of this character in any of the lower molars of the *Rhinoceros tichorhinus* which I have examined; and I have especially compared with the figure given by M. Christol, loc. cit., pl. iii. fig. 1, a molar, the fourth, of the same size and with the same degree of usage. Such small tubercle, notch, or crochet, wherever developed, is most probably an accidental variety.

ging the foundation of a store-house at Chatham, Kent. The figure shows the outer side of the two crescentic or semi-cylindrical lobes, which form the crowns of the lower molars of the Rhinoceros. Douglas presented the specimen to Sir Ashton Lever; and, after the dispersion of the Leverian collection, it was purchased by H. Warburton, Esq., M.P., late President of the Geological Society, and was presented by him to the Museum of the Society.

With regard to other parts of the dentition of the lower jaw of the *Rhinoceros tichorhinus*, allusion has been already made to the traces of sockets of incisive teeth, observed in the expanded symphysis of Siberian and British specimens (p. 334). M. Christol has described and figured the lower jaw of a tichorhine Rhinoceros,* discovered in the post-pliocene marine deposits, ("les sables marins supérieures de Montpellier,") which, like the specimen described by Pallas,† presented four alveoli at the symphysial extremity; the two outer or lateral cavities were two inches deep, and one inch in diameter at the outlet: the left socket contained the base of a fractured incisor; the two middle sockets were reduced to minute circular pits, not exceeding three lines in depth, and four in diameter. The last true molar is not quite in place, and its anterior crescent is very little worn, indicating that the individual with the above-described condition of the lower incisors was scarcely full grown, certainly not an

* Annales des Sciences Naturelles, 1835, tom. iv. pl. 2, fig. 1 and 2. The second premolar (the first in the specimen figured by M. Christol) seems to me to be proportionally too large, and too much advanced, for the species to which this lower jaw is referred.

† The words of Pallas are, "In apice maxillæ inferioris, seu ipso margine, ut ita dicam, incisorio, dentes quidem nulli adsunt; verumtamen apparent vestigia obliterata quatuor, alveolorum minusculorum æquidistantium, è quibus exteriores duo, obsoletissimi, sed intermedii, satis insignibus fossis denotati sunt." Novi Commentarii Petropol., t. xiii. p. 600.

aged animal. The upper incisors appear to be earlier lost; and the traces of those below are generally obliterated in specimens of *Rhinoceros tichorhinus* with the molar series complete.

The characters of other enduring parts of this species, as defined by Cuvier, have been satisfactorily confirmed, not only by the discovery of the almost entire skeleton of the same individual tichorhine Rhinoceros, in the Cave at Wirksworth, but by other not less extraordinary and instructive instances.

In 1816 a considerable portion of the skeleton of a Rhinoceros was discovered by Mr. Whidbey, engineer of the Plymouth Breakwater, in one of the cavernous fissures of the limestone quarries at Oreston, near Plymouth: the following parts, most of which were determined by Mr. Clift, were recovered and preserved:—

Two molar teeth of the upper jaw.
Four do. do. lower jaw.
Portion of the first vertebra, atlas.
Portions of four dorsal vertebræ.
Portions of two caudal vertebræ.
Portions of four ribs.
The symphysial end of an os pubis.
Portions of the right and left scapulæ.
Both articular extremities of the left humerus.
Do. do. right ulna.
Do. do. left radius.
The right os uneiforme.
The middle metacarpal bone of the right fore-foot.
A phalanx of the same toe.
Both articular extremities of the right femur.
Part of both extremities of the left femur.
The left patella.

A fragment of the left tibia.

Two portions of metatarsal bones of the right hind-foot.

The size and form of the teeth, and the thick and strong proportions of the remains of the bones of the extremities, indicate them to have belonged to an animal of the same species as that still more entire specimen discovered in the Derbyshire cavern.

The state of the epiphyses of the long bones proves that the animal had not quite reached maturity; but in the same cavernous fissure, at Oreston, there was found part of the right humerus of an older individual of the *Rhinoceros tichorhinus*.

The broken bones have suffered from clean fractures; none of them are gnawed or waterworn: the cavern containing them was fifteen feet wide, twelve feet high, forty-five feet long; it was filled with solid clay, in which the bones were imbedded: they were situated about three feet above the bottom of the cavern.*

In similar and adjoining caverns (fig. 50, A and B) detached bones and teeth of the same extinct species of Rhinoceros were found; they were associated in one of the fissures with remains of a large species of Deer, and of the *Ursus spelæus;* in another with fossil bones of *Equus*, *Bos*, *Cervus*, *Ursus*, *Canis*, *Hyæna*, and *Felis spelæa*. None of the bones exhibit marks of having been gnawed or broken by the teeth of the great cave-haunting Carnivora; but both these

* Philosophical Transactions, 1817, p. 176: the specimens are now preserved in the Museum of the Royal College of Surgeons, London. One of the bones was analyzed by Mr. Brande, who found it to consist of

Phosphate of lime	60
Carbonate of Lime	28
Animal matter	2
Water and loss	10
	100

and the herbivorous species appear to have perished by accidentally falling into the cavernous fissures before they were filled up by the mud, clay, and drift.

The remains of the Rhinoceros discovered in the cave at Kirkdale, tell a very different story: they manifest, as Dr. Buckland has demonstrated, abundant evidence of the action of the powerful jaws and teeth of the Hyænas, whose copros and vestigia prove that ancient cavern to have been a place of refuge to those Carnivora.* The fossil bones of the Rhinoceroses found in this cavern, as well as in that near Torquay, called Kent's Hole, belonged to animals which inhabited England during the period immediately preceding the deposition of the unstratified drift, and they coexisted with the Mammoth, Hippopotamus, huge Aurochs, Ox and Deer, which likewise became the occasional prey of the Hyænas, whose dwelling-place was thus converted into a kind of charnel-house of the large Herbivora.

The circumstances under which remains of the Rhinoceros have been discovered in the limestone caves of the Mendips, and in those on Durdham Down, lead to similar explanations of their mode of introduction.

The humerus of a Rhinoceros was discovered, associated with remains of the *Hyæna spelæa*, in one of the caves in the carboniferous limestone at Cefn in Denbighshire, at a height of about one hundred feet above the present drainage of the country.† The Rev. Mr. Wilson, of Leyton, has kindly submitted to my examination a collection

* Ante, pp. 141—147.

† These caves were described by the Rev. Edward Stanley, now Bishop of Norwich, in the proceedings of the Geological Society, vol. i. p. 402. Mr. Murchison remarks (Silurian System, p. 552,) that the evidence produced is scarcely adequate to sustain the inference that the cave was inhabited, though it affords satisfactory proof that such wild animals then existed in an adjacent region.

of bones, discovered by the Rev. R. Greaves in a fissure of a limestone rock in Caldy Island, off Tenby, most of which proved to belong to the *Rhinoceros tichorhinus*. A femur of the same species was discovered by Dr. Lloyd in a fissure of the Aymestry limestone. Mr. Murchison, who cites Dr. Lloyd's discovery, proceeds to say, (loc. cit. p. 554) :—

"That quadrupeds of extinct species inhabited this (silurian) region, is proved by the contents of certain gravel heaps on its eastern limits. In a pit, south of Eastnor Castle, where the fragments consist exclusively of silurian rocks and syenite of the adjacent hills, the remains of the Elephant and other animals have been found, and at Fleet's Bank, near Sandlin, the bones of a Rhinoceros and Ox. The latter were found by Mr. J. Allies, who has also collected the bones of the Horse, Rhinoceros, Elephant, &c., at Powick, and those of a Rhinoceros at Bromwich Hill, near Worcester."

Remains of the Rhinoceros were discovered by Mr. Strickland, associated with those of the Elephant and Hippopotamus, in the fluviatile deposits of the valley of the Avon, near Cropthorn, Worcestershire. These deposits appear to form part of the same series which he has traced from Defford, in that county, to Lawford, in Warwickshire, where they have yielded bones of the Rhinoceros in great abundance and perfection. Remains of this Pachyderm were likewise associated with those of the Elephant and Hippopotamus in the analogous fresh-water deposits of the valley of the Thames. The tooth, figured in Mr. Trimmer's Memoir on those at Brentford (Philosophical Transactions, 1813, pl. ix. fig. 2), is an upper molar of a Rhinoceros, not of the Hippopotamus, as there stated.

The fresh-water formations, exposed on the cliffs of our

eastern coast, have yielded very fine remains of more than one extinct species of Rhinoceros.

The *Cambridge Advertiser*, for the 26th of February, 1845, contains the following announcement :—

"Fossil remains; Cromer.—The late high tides have partly uncovered the lignite beds along the base of the cliffs, and among the fossil remains of that stratum have been found a fine specimen of the lower jaw of a Rhinoceros, with the seven molar teeth in good preservation; together with molars of the Elephant, Hippopotamus, and Beaver."

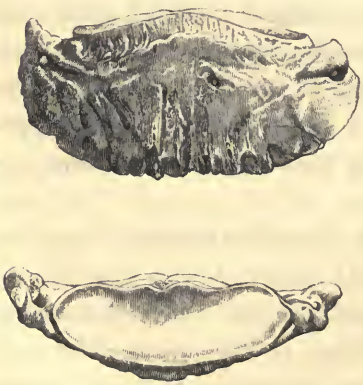
The jaw of the Rhinoceros has been obligingly transmitted to me for examination by its present possessor, Robert Fitch, Esq., F.G.S. It is the left ramus of a young, but nearly full-grown individual of the *Rhinoceros tichorhinus*. The socket of the first small premolar is not obliterated; the second and third premolars, the last deciduous molar, and the first and second true molars, are in place: the crown of the last true molar is just about to emerge from its alveolus; the last premolar is concealed in the substance of the jaw, beneath the third much worn tooth in place. This interesting specimen, which exemplifies one of the later stages of the dental changes of the extinct Rhinoceros, will be again adverted to in comparison with a corresponding fossil of the *Rhinoceros leptorhinus*.

With regard to the most instructive remains of the Rhinoceros from Lawford near Rugby, Cuvier (loc. cit. p. 80) expressly refers the cubitus to the 'espèce cloisonnée;' and again, with regard to the 'os innominatum,' he says, that it seems to belong to the species with the osseous septum, viz. the *Rhinoceros tichorhinus*: in reference to the tibia and the cervical vertebræ, Cuvier confines his

observations to their differences as compared with the recent *Rhinoceros indicus* (p. 84), or to their want of sufficiently distinguishing characters (p. 76).

Dr. Buckland possesses some very fine and perfect specimens of the humerus of the *Rhinoceros tichorhinus*, from Lawford, of one of which Cuvier has given figures in pl. xv. figs. 5 and 6, of the volume above cited. The humerus is remarkable in the Rhinoceros, and especially in the great extinct tichorhine species, for its strength and the enormous thickness of the upper end; in one of the Lawford specimens the circumference at that end is two feet, the entire length of the bone being one foot, seven inches. The great tuberosity is developed into a strong curved plate, which bends over the broad and deep bicipital groove: the deltoid crest, continued downwards from the tuberosity also manifests prodigious strength. Cuvier remarks that the trochlear articular surface for the radius is more oblique, and its lower crest longer, in the fossil, than in the recent Rhinoceros of India.

Fig. 129.



I subjoin two views of an ungual phalanx of a Rhinoceros (fig. 129), which was obtained from the brick marl, at Gray's Thurrock, Essex; an opportunity of examining this fossil, and of giving these illustrations, having been kindly afforded me by Mrs. Mills, of Lexden Park, near Colchester. The upper figure shows the rough anterior surface of the bone, sculptured by the canals for the blood-vessels, sup-

plying the secreting organ of the thick hoof which once adhered to it: the under figure shows the smooth articular surface which played upon that of the second phalangeal bone.

Of the bones of the hind extremity Dr. Buckland's collection at Oxford contains a rich series, from which, indeed, Cuvier derived much of his knowledge of the anatomical distinctions of this part of the skeleton of the *Rhinoceros tichorhinus*. He figures a fine specimen of the os innominatum, or haunch-bone, (tom. cit. pl. xiv. figs. 1 and 2,) which, compared with that bone in the existing one-horned and two-horned Rhinoceros, exhibits a narrower and longer "foramen ovale:" the lateral borders of the iliac bones are more oblique and more concave towards the neck; the anterior border is less convex, especially towards the external angle; and this angle is narrower, more pointed, and not forked; the external angle of the tuberosity of the ischium is also more pointed. The femur or thigh-bone of the Rhinoceros may be distinguished from that of the Hippopotamus, Aurochs, and other large herbivorous quadrupeds of similar size, by a flattened process extending outwards from near the middle of the outer part of the shaft: this process is termed the "third trochanter." The shaft is broad and flat, especially at the upper end. I have compared the proximal part of the thigh-bone of the young Rhinoceros from Oreston, in which the hemispherical articular head and the great trochanter were in the state of detached epiphyses, with the femur of a young *Rhinoceros indicus* in the same state, and found the depression for the ligamentum teres shallower in the fossil: the post trochanterian depression is also shallower, and the third trochanter smaller. The shaft is thicker in proportion to the lower condyloid expansion

than in the African, Indian, or Sumatran Rhinoceros; and the fore part of the shaft, above the joint for the patella, or knee-pan, is more excavated than in the other fossil species found in Britain, viz., the *Rhinoceros leptorhinus*.

Although the remains of the great tichorhine Rhinoceros have not been found in such abundance in the caves, the unstratified drift, and the post-pliocene fresh-water deposits of Britain, as those of its more gigantic contemporary the Mammoth, the two-horned Pachyderm seems to have been as extensively distributed over the land which now constitutes our island. The works of continental palæontologists demonstrate that this Rhinoceros was similarly associated with the Mammoth in the more recent deposits of France, Germany, and Italy.*

But the most abundant as well as the best preserved specimens of the tichorhine Rhinoceros have been discovered in the northern latitudes of Asia, which appear to have been the regions most frequented by it; and where the same evidence has been obtained of its special adaptation to colder climates than those inhabited by existing Rhinoceroses, as that which has been previously detailed in reference to the Mammoth.

The very remarkable discovery of the extinct Rhinoceros preserved in ice was made nearly twenty years before the analogous one of the frozen Mammoth, noticed in a foregoing section;† and is narrated by Pallas in the 4th volume of his 'Voyages dans l'Asie Septentrionale,' (4to., 1793, pp. 130—132), as follows:—

"I ought here to mention an interesting discovery,

* Cuvier showed that the famous fossil Morse of Monti, discovered at Mont Blancano, near Bologna, was the lower jaw of the *Rhinoceros tichorhinus*, (tom. cit. p. 73.)

† Ante, p. 263.

which I owe to M. le Chevalier de Bril. Certain Jakoutzki hunting this winter" (1771-2) "near Viloui, found the body of a great unknown beast. The Sieur Ivan-Argounof, Inspector of Zimovia, caused to be transmitted to the Prefecture of the province of Jakoutzk the head, a fore-foot, and a hind-foot of the animal, the whole of which were in an excellent state of preservation.* He says in his Memoir, dated the 17th of last January," (1772) "'that they found, in the month of December, the animal dead, and already much decomposed,† at about forty versts above Zimović de Vilouiskoe, on the sand of the bank, at the distance of one toise from the water and four toises from another higher and more precipitous escarpment: it was about half buried in the frozen sand. They took its dimensions on the spot: it was three and three quarters Russian ells' (aunes de Russie, about eleven and a half English feet) 'in length, and they estimated its height at three and a half ells. The body of the animal, still retaining its corpulency,' (encore dans toute sa grosseur,) 'was clothed with its skin, which resembled leather; but it was so far decomposed that they were unable to bring away more than the head and the feet. These I saw at Irkoutsk; they seemed to me, at the first view, to belong to a Rhinoceros, which had been in full vigour. The head, especially, was very recognisable, because it was covered by its skin. The skin had preserved all its exterior organization, and one could see upon it many short hairs,' (*on y appercevoit plusieurs poils*

* Pallas, in a more elaborate account of the same discovery which he communicated to the Imperial Academy of Sciences at Petersburg, states, "Reliquum vero cadaver, corruptum valde, licet corio naturali adhuc obvolutum, in loco relictum, periit:" Novi Commentarii Petropol., 1773, tom. xvii. p. 587.

† In his Memoir in the Petersburg Transactions, Pallas observes, "fœtorem spirabant non recens corruptarum carnium, sed latrinis prorsus antiquis comparandum, quasi ammoniacalem." Loc. cit. p. 589.

courts). 'The eyelids and eyelashes even had not entirely fallen into decay. I saw a substance in the cavity of the skull; and here and there, beneath the skin, were the remains of the putrified flesh. I remarked on the feet the very obvious remains of the tendons and cartilages, where the skin was wanting. The head had lost its horn,* and the feet their hoofs. The situation of the horn, the fold of integument which surrounded it, and the separation' (of the toes?) † 'which existed in the fore-feet and hind-feet are certain proofs of the animal being a Rhinoceros.' I have given an account of this singular discovery in the Memoirs of the Academy of Petersburg, and refer my readers to that work to save repetition. They will there see the reasons in proof that a Rhinoceros has been able to penetrate near the Lena in high northern latitudes, and the circumstances that have led to the discovery in Siberia of the remains of so many strange animals."

In this Memoir, Pallas specifies the short hairs, strongly implanted in pores of the skin covering the vertex, and growing in tufts (fasciculatim nascentes) from the sides of the mandibular region, of rigid texture and cinereous grey colour, with here and there a black hair longer and stiffer than the rest. The hairs adhered to many parts of the skin of the legs, from one to three lines long, of a dirty cinereous colour. So much hair as grew from the parts of the frozen Rhinoceros observed by Pallas, he never

* "La tête étoit dégarnie de sa corne," are the words of the French translator and editor Peyronie; but Pallas, in his Memoir, expressly mentions the two horns: "*Cornua* cum capite adlata non fuerunt, prius forte abrupta et a flumine vel transeuntibus gentilibus, qui venationi operam navant, ablata. Apparent autem *cornu nasalis* pariter atque *frontalis* evidentissima vestigia." Novi Comment. Petropol., tom. xvii. p. 588.

† In the Memoir, "De Reliquiis animalium exoticorum," Pallas, speaking of the feet, says, "In quibus non solum divisura ungularum, Rhinocerotis characteristica, sed corium pariter," &c.

observed on any living species; and he asks whether it does not indicate the Rhinoceros of the Lena to have been an aboriginal of the temperate latitudes of Asia?

It must not be inferred from the observations which Pallas was able to make on the hair of the legs of the frozen Rhinoceros, that its body was less warmly clad than that of the Mammoth. No naturalist, unacquainted with the woolly covering of the arctic Musk Ox, could have inferred it from an inspection of the legs only, which are clothed with short, dull, brownish-white hair, unmixed with wool.

Of the subsequent discoveries of carcasses of Rhinoceroses in the frozen soil of Siberia, I can only learn that they prove the hide to have been destitute of those singular folds which characterize that part in the existing one-horned Rhinoceros; and that one of the horns, probably the first or nasal horn, has been obtained, which measures nearly three feet in length, and thus confirms the deductions of Cuvier from the osseous septum supporting the nasal bones, as to the size of this formidable weapon: it is preserved in the Museum of Natural History at Moscow.

Although the molar teeth of the *Rhinoceros tichorhinus* present a specific modification of structure, it is not such as to support the inference that it could have better dispensed with succulent vegetable food than its existing congeners; and we must suppose, therefore, that the well-clothed individuals who might extend their wanderings northwards during a brief but hot Siberian summer, would be compelled to migrate southward to obtain their subsistence during winter. Plants might then have existed with longer periods of foliation than those which now grow. This, at least, is a less extreme hypothesis than the sudden change from a tropical to an arctic climate,

which has been proposed to account for the preservation in ice of entire Elephants and Rhinoceroses; and Mr. Darwin has well remarked that "as there is evidence of physical changes, and as the animals have become extinct, so may we suppose that the species of plants have likewise been changed." But, admitting the more probable necessity of migration, we may derive some insight into the habits of the Siberian Rhinoceros by inquiring into those of existing large Herbivora of Arctic climes, which were represented by species coeval with those extinct Rhinoceroses. Pallas describes and figures in the same Memoir "De reliquiis animalium exoticorum" in which he describes the frozen Rhinoceros, the fossil remains of a Musk Ox (*Ovibos*, De Bl.), which seems to be not more satisfactorily distinguishable from the existing species* than is the *Urus priscus* from the great Lithuanian Aurochs: the Musk Ox is remarkable at the present day for its geographical position in high northern latitudes, and its adaptation to such by its peculiarly fine woolly clothing, and its periodical migrations have been noticed by experienced naturalists. The appearance of the Musk Ox in the month of May on Melville Island in latitude 75°, was one of the phenomena ascertained in Captain Parry's first voyage, and "is interesting," Dr. Richardson observes,† "not merely as part of their natural history, but as giving us reason to infer that a chain of islands lies between Melville Island and Cape Lyon, or that Wollaston's and Banks's Lands form one large island, over which the migrations of the animals must have been performed."

* Cuvier, 'Ossemens Fossiles,' 4to. 1823, tom. iv. p. 156.

† 'Fauna Boreali-Americana, Mammalia,' p. 276.

Fig. 130.

Section of the Dream Cave at Wirksworth, (Buckland, 'Reliquiæ Diluvianæ,') showing the position of the fossil Rhinoceros, E.

Fig. 131.

Upper part of skull, *Rh. leptorhinus*, $\frac{1}{8}$ nat. size. Clacton, Essex.

RHINOCEROS LEPTORHINUS. Leptorhine Two-horned Rhinoceros.

Rhinoceros leptorhinus, ou Rh. à narines non-cloisonnées et sans incisives,	Cuvier, Ossemens Fossiles, 4to., 1822, tom. ii., pt. 1, p. 71, pl. ix. figs. 8 and 9; pl. xiii., figs. 4 and 5.
„ *Kirchbergense,*	Jäger, Die Fossilen Sæugethiere, Wurtemberg, fol. 1839, p. 179, tab. xvi., figs. 31, 32, 33.
„ *Merckii,*	Kaup, Akten der Urwelt, 8vo., 1841, p. 6, tab. i., figs. 1, 3, 4, and 5; tab. ii.

Whilst the catalogue of extinct European Rhinoceroses has been augmented, since the time of Cuvier, by a few well-determined and many nominal species, one, which the great Palæontologist had himself inscribed there by the name of *Rhinoceros leptorhinus*, has been almost blotted out and lost sight of, through the defective character of part of the evidence on which he founded the species.

The name '*leptorhinus*' and its French synonym '*à narines non-cloisonnées*,' more commonly applied by

Cuvier to the species in question, were suggested by the characters of the fossil skull of a Rhinoceros discovered by M. Cortesi in a fresh-water upper tertiary deposit at Plaisance, as they appeared in a drawing transmitted to Cuvier, who had not had an opportunity of studying the original, which is preserved in the 'Musée des Mines' at Milan. Confiding in the drawing, which is engraved in the 'Ossemens Fossiles,' 4to., 1822, tom. ii., pt. i., Rhinoceros, pl. ix., fig. 7, Cuvier was led to conclude that the Rhinoceros of Plaisance differed from that of Siberia and northern Europe in having "the cerebral part of the skull less prolonged and less inclined backwards; in the position of the orbit above the fifth molar tooth; in the anterior termination of the nasal bones by a free point, and in the absence of any attachment of them to the intermaxillaries by a vertical osseous septum; in the minor degree of prolongation of the intermaxillary bones, which were of a totally different form, presenting, in short, as little as the nasal partition, any of those characters for which the skull of the *Rhinoceros tichorhinus* was so remarkable." (Tom. cit. p. 71.) From these apparently broad distinctions, Cuvier did not hesitate to admit the specific difference of M. Cortesi's Rhinoceros; and he even ventured to state that it incontestably approached nearer to the *Rhinoceros bicornis* of the Cape than to any other known species. (Tom. cit. p. 71.)

This summary of the cranial characters of the *Rhinoceros leptorhinus* is repeated without modification in the posthumous 8vo. edition of the 'Ossemens Fossiles,' 1834, tom. iii., p. 136.

In the following year, however, M. de Christol communicated to the 'Annales des Sciences,' 2de série, tom. iv., p. 44, a more accurate figure (pl. ii, fig. 4) of the cranium

of the Rhinoceros discovered at Plaisance, and the results of a careful comparison of three large drawings of that fossil, made at his request by MM. de la Marmora and Gené at Milan; from which he was led to conclude that the drawing published by Cuvier was very defective in one of the most essential points, and had led the great Anatomist into the error of creating a species which had never existed.*

M. Christol found, in fact, that the bony septum of the nose had been omitted in the sketch engraved in the 'Ossemens Fossiles,' whilst a considerable portion of it actually existed in the fossil; and that the anterior extremity of the nasal bones, represented as projecting freely forwards in the Cuvierian figure, were evidently broken off in the actual fossil, according to the large drawings transmitted to him by Prof. Gené. (Loc. cit. p. 70.)

The discrepancies between the figures published by Cuvier and M. Christol are obvious enough; and one can scarcely avoid conceding to the later observer, that he has established the fact of the existence, in M. Cortesi's fossil, of the chief character, viz., the bony partition of the nose, the absence of which was mainly depended on by Cuvier as the distinctive feature of his *Rhinoceros à narines non-cloisonnées*. Since, however, this species rests not only upon M. Brongniart's drawing of the skull at Milan, but upon characters deduced, by Cuvier's own observation, from lower jaws obtained from fresh-water deposits in Italy, M. Christol, who had not any more than Cuvier

* "Cuvier n'a pas eu occasion de la voir, il n'a pu en décrire la tête que d'après un dessein qui, tout en retraçant assez exactement les contours généraux de cette tête, est très incomplet dans le point le plus essentiel, et me paraît avoir induit Cuvier en erreur en le portant à créer une espèce qui n'a point existé." Christol, loc. cit. p. 47.

personally inspected or compared M. Cortesi's fossil, expects too much when he demands the entire suppression of the *Rhinoceros leptorhinus* from the catalogue of extinct species.

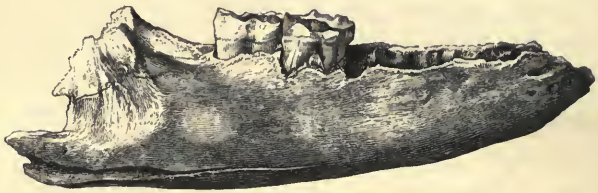
I shall be able, indeed, to show that the partial bony septum, and its confluence with the extremities of the nasal bones, inferred by M. Christol to exist in the skull of the Rhinoceros at Milan, do not, of themselves, give proofs of its identity with the species called *Rh. tichorhinus;* and although, in the absence of direct inspection of the fossil in question, I cannot presume to question the accuracy of M. Christol's determination of it, I may observe that the points above cited, upon which he chiefly grounds his opinion, are not incompatible with the characters which I have ascertained to belong to the skull of the *Rhinoceros leptorhinus*.

Before adverting to these, I shall first adduce evidence of the existence, in British fresh-water newer-pliocene deposits, of a Rhinoceros, having the same characters of the lower jaw and teeth which Cuvier has ascribed to his *Rhinoceros leptorhinus*.

The specimens described and figured in the 'Ossemens Fossiles,' tom. cit. pl. ix., figs. 8 and 9, were discovered in Tuscany, and are the most common kind of Rhinoceros jaws in that part of Italy, where, however, the lower jaw of the *Rhinoceros tichorhinus* has likewise been found. From this the jaw of the *Rh. leptorhinus* differs "by the continuation of the series of molar teeth close to the anterior end of the jaw, which is short and not prolonged into a prominence, or expanded part;" and these characters Cuvier correctly cites as evidence of the close resemblance of the leptorhine Rhinoceros to the two-horned species of the Cape. (Tom. cit. p. 72.) The fossil speci-

men (fig. 132), which, in like manner, differs as much from the lower jaw of the *Rh. tichorhinus* (fig. 123) as it resembles that of the *Rh. bicornis*, was discovered by John Brown, Esq., F.G.S., in the fresh-water pliocene deposits

Fig. 132.



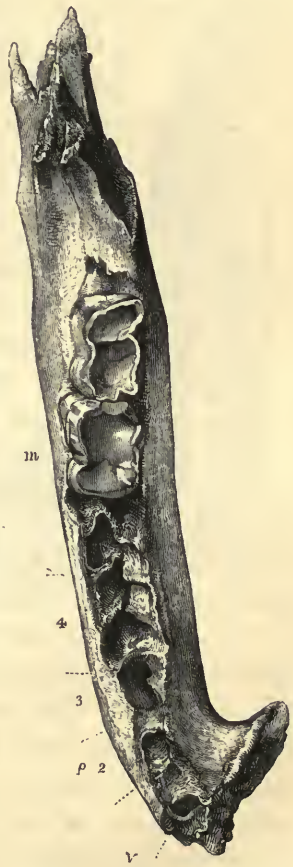
Lower jaw, *Rh. leptorhinus*, $\frac{1}{8}$ nat size. Clacton, Essex.

at Clacton on the Essex coast. It consists of the right branch of the lower jaw, wanting the angle and coronoid ascending process and the end of the symphysis, and it contains the last and penultimate molars, and the sockets of four molars anterior to these. The entire length of the specimen is one foot six inches and a half; the depth of the jaw behind the last molar tooth is four inches nine lines; its depth behind the third molar tooth is three inches four lines. The extent of the molar series, from the front of the second socket to the back of the last socket, is ten inches. I assume the anterior alveolus, (fig. 133, *p* 2,) which lodged a two-fanged premolar, exceeding one inch in antero-posterior extent, to have been the second of the series; the deep depression, exposed on the broken part of the symphysis anterior to this socket, is the dental canal; it is shown at *v*, fig. 133, in which a view of the alveolar border of the jaw is given on the same scale as that of the figure of the lower jaw of the *Rhinoceros leptorhinus* in the 'Ossemens Fossiles' (tom. cit. pl. ix., fig. 9), which

appears to be the same scale as that on which Dr. Kaup's specimen of the lower jaw of the *Rhinoceros Merckii* is figured in the 'Akten der Urwelt,' tab. ii.

The socket of the second molar, (*p* 2,) or the sixth, counting from behind forwards, is entirely in advance of the transverse line drawn across the back part of the symphysis, and the molar series is consequently extended much closer to the end of the jaw than in the *Rhinoceros tichorhinus*. This part of the symphysis also is rounded inwards towards its anterior termination in the present specimen, producing a very different contour from that produced by the swelling out of the same part to form the flattened spatulate extremity, characteristic of the lower jaw of the *Rh. tichorhinus* (fig. 124). The lower border of the jaw is less curved in the *Rh. leptorhinus*, and the depth less suddenly diminished at the symphysis. The fore-part of the base of the coronoid process is more prominent externally in the *Rh. leptorhinus* than in the *Rh. tichorhinus*. The molar teeth are larger, and the series occupies a greater extent in the jaw of the leptorhine species.

Fig. 133.



Lower jaw, *Rhinoceros leptorhinus*. ¼th nat. size. Clacton, Essex.

	Rh. leptorhinus.		*Rh. tichorhinus.*	
	In.	Lin.	In.	Lin.
Antero-posterior extent of last two molars .	4	3	3	9
„ „ penultimate molar .	2	0	1	9
Transverse diameter of base of crown of penultimate molar	1	6	1	2

In the present specimen of the jaw of the leptorhine Rhinoceros (fig. 133), the worn state of the last two molars shows that it had belonged to an old individual: but the difference of size is equally manifested by the specimen of a fragment of the left branch of the lower jaw of the *Rhinoceros leptorhinus* (fig. 134), also obtained by Mr. Brown from the fresh-water deposits at Clacton, and containing the last three molars, in the same state of attrition as those in the jaw of the *Rhinoceros tichorhinus* (fig. 124). There is a difference also in the proportional size of the posterior lobe of the last molar tooth, which is greater in the *Rh. leptorhinus*. The lower terminations of the internal depressions of the molars are less angular and less narrow in the *Rh. leptorhinus*; and the three inner columns or prominences of the molars are less flattened.

Fig. 134.

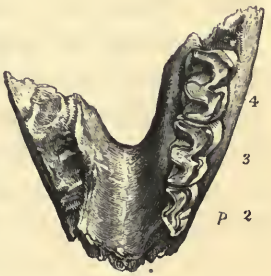
Rhinoceros leptorhinus. ¼ nat. size. Walton.

The specimen of the fore part of the lower jaw of a somewhat younger leptorhine Rhinoceros, obtained by Mr. Brown from the fresh-water deposits at Clacton, Essex, and containing the second, third, and fourth premolars *in situ* (fig. 135), yields a specific character in the larger proportional size of the second premolar; which will be recognized by comparing the annexed figure with fig. 128, and is demonstrated by the following admeasurements:

	Rh. leptorhinus.		*Rh. tichorhinus.*	
	In.	Lin.	In.	Lin.
Antero-posterior extent of second, third, and fourth premolar	4	3	4	0
„ „ second premolar .	1	3	1	0
„ „ fourth premolar .	1	7	1	7

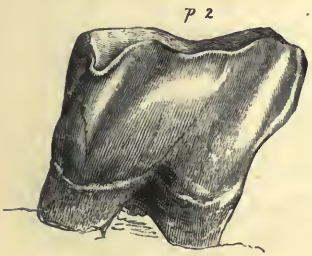
There is a still more marked distinction of form, which, as it is rarely manifested in the lower molars of the Rhinoceros genus, I have here illustrated by two cuts of the natural size; fig. 136, showing the inner side of the second premolar of the *Rhinoceros leptorhinus*, and fig. 137, *p* 2, that of the *Rh. tichorhinus*, the latter being from Lawford, near Rugby.

Fig. 135.



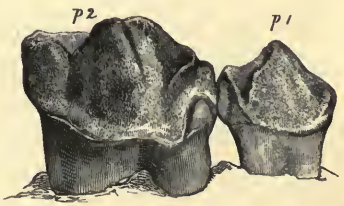
Rhinoceros leptorhinus, rather less than ¼ nat. size. Clacton.

Fig. 136.



2nd premolar, nat. size. *Rhinoceros leptorhinus*. Clacton.

Fig. 137.



1st and 2nd premolars, nat. size. *Rhinoceros tichorhinus*. Lawford.

In Dr. Buckland's collection at Oxford there is a specimen of a considerable part of the right ramus and symphysis of the lower jaw of a young, but nearly full grown, *Rhinoceros leptorhinus*. The last molar tooth has half risen above its alveolus, and the summit of the anterior crescent had just begun to be used in mastication: the

penultimate grinder is in place, the sockets of the ante-penultimate molar, and of the three adjoining premolars, vacant; that of the first premolar is obliterated: the whole of the socket of the second, and part of that of the third premolar are in advance of the back part of the symphysis. Besides this well-marked distinctive character, the present fossil displays the more convex curvature of the lower border of the jaw, its greater thickness in proportion to its depth below the premolar series. These differences are well brought out in contrast with the portion of jaw from the fresh-water beds of the Cromer Cliff, which belonged to a younger individual, and of which comparative admeasurements are subjoined:—

	Rh. leptorhinus.		*Rh. tichorhinus.*	
	In.	Lin.	In.	Lin.
Depth of jaw below the middle of third premolar	2	0	3	0
Greatest thickness of the same part of the jaw	1	7	1	8
Depth of the jaw below middle of the penultimate molar	3	0	3	5
Antero-posterior breadth of penultimate molar	2	0	1	9
„ „ of last molar . .	2	3	1	8

The last two admeasurements show the characteristic superior size of the molar teeth in the *Rh. leptorhinus*.

Dr. Kaup has described and figured a portion of a lower jaw of a Rhinoceros discovered in the Rhine formations ("im Rheine gefunden"), the left ramus of which, according to the figure,* contains the fourth, fifth, and sixth molars, the roots of the third and second, and the anterior root of the seventh molar; the second molar being in advance of the posterior commencement of the symphysis, as in the lower jaw of the *Rhinoceros leptorhinus* of Italy, figured by Cuvier (loc. cit. Rh. pl. ix., fig. 9), and as in the specimen from Clacton, figs. 132 and 133.

Dr. Kaup, believing that in his Rhenish specimen the

* 'Akten der Urwelt,' tab. ii., fig. 1, p. 6.

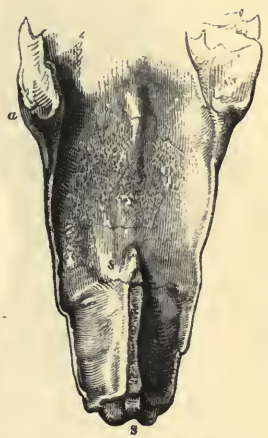
teeth occupy a greater space, and that the edentulous end of the symphysis is broader than in the jaw of the *Rh. leptorhinus*, figured by Cuvier, refers it to a distinct species, which he calls *Rhinoceros Merckii*. The symphysis is not, however, entire in either of the specimens compared, according to the figures, from which I can by no means satisfy myself of their specific distinction. The length of the alveolar series, from the sixth to the second molar, inclusive of the specimen from Clacton (fig. 133), is 0·205 in French millemetres, or eight and a quarter inches English; in the Italian specimen, and also in that from the Rhine, if Dr. Kaup's figure be, like Cuvier's, one-fourth the natural size, the same dimension gives 0·225 millemetres, or nine inches: but different specimens of the lower jaw of the *Rhinoceros tichorhinus* have presented as much variety of size. I conclude, from the foregoing comparisons, that the lower jaw of the Rhinoceros from the Rhenish deposits, as well as that from Essex, are specifically identical with the lower jaws from Tuscany, which Cuvier has referred to his *Rhinoceros leptorhinus*.

But what are the characters of the rest of the cranium, and in what degree do the proportions of the nasal bones accord with the name imposed upon the species which the lower jaw incontestably proves to be distinct from all other species known at the period of its first description? M. Christol has shown that the answers given to these questions on the authority of the cranium discovered by M. Cortesi are unsatisfactory. No portion of the upper jaw or cranium was associated with the Rhenish specimen of the lower jaw of the *Rhinoceros leptorhinus* described by Dr. Kaup. But the discoverer of the corresponding portion of the same species in our own freshwater deposits was so fortunate as to obtain, by his own

personal exertions, at the same time and place, the whole of the upper portion of the cranium, with a considerable proportion of the occiput, and a fragment of the upper jaw with the last molar tooth *in situ;* other upper molars being found detached, but in close proximity with the cranium. The side-view of this portion of cranium (fig. 131), reduced to the same proportion as that of the *Rh. tichorhinus* (fig. 120), shows the minor degree of elevation of the interorbital platform supporting the second or frontal horn, the minor degree of concavity between this surface and the cranium proper, the greater length of the nasal aperture, and the less prominent or convex contour of the anterior and rougher surface for the nasal horn: the limited extent of the bony partition-wall (*s s*), dividing the nasal cavity, and supporting the nasal bone, is also shown in this view, the lower part of the wall being broken away, but not the posterior margin, which terminates by a smooth rounded border. The bony partition-wall extends, in fact, from the anterior end of the nasal bones, only half-way towards the posterior boundary of the nasal apertures (*a a*), the view across the posterior half of which is uninterrupted. In the *Rhinoceros tichorhinus* the bony septum extends from the fore-part of the nose to the vomer behind, and serves to support not only the nasal, but the frontal horn. That the well-marked but interesting transitional character of the partial bony septum is not a fallacious appearance due to accidental loss or fracture, is demonstrated by the under or inner surface of the nasal platform, of which a reduced view is given in fig. 138. This surface, behind the bony septum (*s s*), is quite smooth and free from any marks of sutural attachment of an unanchylosed prolongation of a bony vomer; the surface is slightly

convex transversely, concave longitudinally, with the free lateral margins bent down. The short septum is firmly anchylosed,* and gradually increases in thickness to the anterior deflected extremities of the nasal platform, where the appearance of the fractured surface of the confluent bones indicates that, when entire, they had been united by continuous ossification to the intermaxillaries, as in the *Rhinoceros tichorhinus*.† Very clear evidence of the distinction of the two species is obtained by comparing the upper surfaces of their skulls; and the reader may pursue the same comparison by means of the subjoined figure (139), and the

Fig. 138.



Under surface of nasal bones of *Rhinoceros leptorhinus*. $\frac{1}{8}$ nat. size. Clacton.

* This fact shows that the limited extent of the bony septum in the present cranium is not a consequence of immature age; not only the size of the skull, but the obliteration of the cranial sutures, proves it to have belonged at least to a fully mature individual. In the tichorhine Rhinoceros the bony septum is not anchylosed to the nasal platform until the animal has quite attained its maturity. In the young but full-grown specimen discovered in the frozen sand at Viloui, the bony septum was still free at its upper border. Pallas says, "Os scutiforme, quod cornu nasalis firmamentum præstat cum subjecto fulcro osseo, crassissimo vomeri comparando nondum evaluit; sed harmoniâ tuberculosâ totius plani, ut epiphyses ossium juniorum solent, inarticulatur." Novi Comment. Petropol. xvii. (1773), p. 590.

† When I first saw this specimen at Stanway during a tour of inspection of collections of British Fossils, preparatory to drawing up the Report on that subject for the British Association, I was induced, from the prevalent belief in the osseous septum anchylosed to the nasal bones as the peculiar characteristic of the *Rhinoceros tichorhinus*, to refer the Clacton cranium with those characters to that species; this error in the 'Reports of the British Association,' 8vo., 1843, p. 222, I am now able to correct.

Fig. 139.

Upper surface of the skull of *Rhinoceros leptorhinus*. $\frac{1}{8}$ nat. size. Clacton.

corresponding view of the skull of the *Rh. tichorhinus*, given by Cuvier in the 'Ossemens Fossiles,' 4to., 1823, tom. iii., pl. lxxix., fig. 5.

So compared, the Clacton specimen will be seen to be narrower in proportion to its length, especially at the cerebral and nasal regions: the confluent nasal bones (*n*) are not only more slender, but are more attenuated anteriorly, and thus vindicate the appropriateness of the name *leptorhinus* originally applied to the present species by its first discoverer.* The interorbital surface (*f*) for the frontal horn is not only less elevated, but is much less rugose, and is separated by a smooth space of some extent from that (*n*) for the

* The French name, *Rhinoceros à narines non cloisonnées*, more commonly applied by Cuvier to this species, is now proved to be inapplicable; the more accurate term would be *à narines demi-cloisonnées;* but, as the nasal bones notwithstanding their partial osseous supporting wall, are actually more slender than those of the *Rh. tichorhinus*, there is no objection to the Latin nomen triviale *leptorhinus*, and every reason for retaining it.

nasal horn. We may therefore infer, from the latter character, that the second horn was smaller in the leptorhine than in the tichorhine Rhinoceros, and connect in physiological relationship with this indication the non-extension of the bony supporting wall beneath the second platform.* Another distinction is the narrower interspace between the curved ridges (*t t*) which indicate the extent of origin of the temporal muscles upon the sides of the cranium: and this is not due to any difference of age; for the skull of the tichorhine Rhinoceros, with which I compared the Clacton specimen, belonged to an old individual, and yet exhibited the same superior width between the temporal ridges as is shown in the Cuvierian figure above referred to. The plane of the occiput is less inclined from below upwards and backwards than in the *Rh. tichorhinus*, and this region of the skull of the leptorhine species differs more strikingly in its form (fig. 140): it is narrower in proportion to the length of the skull, and especially at the upper part, which gives it a triangular figure with the apex cut off. In the *Rh. tichorhinus* it is more square-shaped, and the upper overhanging ridge is thicker and more rugged, indicating more powerful ligamentous and muscu-

Fig. 140.

Occiput of *Rhinoceros leptorhinus*. $\frac{1}{8}$ nat. size. Clacton.

* The existing species of two-horned Rhinoceroses of Africa present the same difference in the proportions of their horns, as was manifested by the two extinct European species above compared. The *Rh. Keitloa* of Dr. Smith has both horns of equal length; the *Rh. simus* has the frontal horn much shorter than the nasal one.

lar attachments in relation to the stronger and heavier horns.*

The true characters of the skull of the *Rhinoceros leptorhinus*, and its distinction from that of the *Rh. tichorhinus* being established, there remains only to compare it with the skulls of other known species of Rhinoceros. The descriptions by Cuvier, 'Ossemens Fossiles,' 4to., 1824, tom. v., pt. ii., p. 502; by Dr. Kaup, 'Ossemens Fossiles de Darmstadt,' 4to., 1834, 3me cahier, p. 39, and by M. Christol, 'Annales des Sciences Nat.,' 1835, p. 76, of the extinct two-horned species, referred by Cuvier to his *Rh. incisivus*, but first accurately determined by Dr. Kaup under the name of *Rh. Schleiermacheri*, and shortly after by M. Christol under that of *Rh. megarhinus*, leave no room for doubt as to its specific distinction from the *Rh. leptorhinus*. Cuvier and Dr. Kaup are silent as to the presence or otherwise of a bony nasal septum in the *Rh. Schleiermacheri*, and the excellent figure of the skull of that species in Dr. Kaup's work shows no trace of it. It is equally absent in the original figure of the Montpellier specimen, given by M. Christol in the 'Annales des Sciences,' tom. cit., pl. ii., fig. 5; and the latter author expressly states "that

* These specific distinctions of the *Rh. tichorhinus*, and *Rh. leptorhinus*, will be readily appreciated by the subjoined table of comparative dimensions:—

	Rh. tichorhinus.		*Rh. leptorhinus.*	
	In.	Lin.	In.	Lin.
Length of the skull (in a straight line) .	31	0	28	0
Least breadth between temporal ridges .	3	6	1	5
Breadth of nasal bones opposite the hind border of the nasal aperture . . .	6	0	5	10
Breadth, opposite middle of nasal aperture .	6	6	4	9
Breadth of the anterior extremity of nasal platform	4	0	2	9
Length of nasal aperture	8	0	8	10
Breadth of upper part of occiput	8	0	4	0
Do. of middle of occiput . . .	9	6	6	9

the nasal bones are broad, long, straight, horizontal, not massive, but strong and 'élancés,' without a septum below ('sans cloison en dessous'), abruptly bent down near their free extremity, which terminates in a point directed downwards and a little forwards," *ib.* p. 77. The marked difference in the form of the cranium of the *Rh. leptorhinus*, besides that essential structural one in the presence of the osseous septum, will be appreciated by comparing the contour of the nasal platform in fig. 131 with M. Christol's figure and accurate description of the same part in the *Rh. Schleiermacheri*. Cuvier deemed the skull of this species to resemble that of the Sumatran two-horned Rhinoceros more than any other, but to be proportionally shorter, with the nasal platform broader and less pointed, its convexity more prominent, and the temporal ridges more approximated, so as to form a sagittal crest. (Tom. cit. p. 502.) Now, in each of these particulars, the *Rh. Schleiermacheri* equally departs from the *Rh. leptorhinus;* which, by its proportionally longer cranium, with a narrower and more gradually attenuated nasal platform (fig. 139, *n*), presenting a more gradual and less elevated convex curve (fig. 131), and with the flat space intervening between the less approximated temporal ridges, still more nearly resembles the skull of the *Rh. Sumatranus* than does that of the *Rh. Schleiermacheri*. The *Rh. leptorhinus* differs, nevertheless, from the *Rh. Sumatranus* (see Cuv., op. cit., tom. iii., pl. lxxix., fig. 3) in its proportionally longer and narrower cranium, in the more backward production of the occipital ridge, and still more essentially by the ossified septum and its confluence with the fore-part of the nasal bones. From the skull of the *Rhinoceros incisivus*, to which Cuvier erroneously supposed that of Schleiermacher's species to belong, our present specimen is readily distinguished by

both its shape, its partial bony septum, and the surfaces for the attachment of the horns; which surfaces are shown, by Dr. Kaup's beautiful discovery, to be wanting in that accordingly hornless extinct Rhinoceros, which, by way of compensation, was provided with unusually large incisive tusks. (Kaup, loc. cit., p. 109, pl. x.) By the absence of incisors, and by the form of the lower jaw, the *Rh. leptorhinus* resembled the incisorless *Rhinoceros bicornis* of the Cape; but, by the form and proportions of the cranium, it much more nearly resembled the two-horned Rhinoceros of Sumatra, and thus combined in its own organization characters now distinct, and shared between two existing Rhinoceroses, the habitats of which, in the present geographical distribution of Mammalia, are divided by a thousand miles of ocean.

Our chief information of the extent of the range of the extinct species of Rhinoceros is derived from the discoveries of their fossil teeth, which are the most common and the most recognizable remains of these great Pachyderms.

Cuvier expresses his regret that he had had no opportunity of examining the superior molar teeth of the *Rhinoceros leptorhinus*, so that he knew not whether they presented characters analogous to those which distinguish the molars of the existing species. He appeals to the Italian naturalists to supply this hiatus; and to this desirable object the specimens which were obtained by Mr. Brown in the same deposits at Clacton, with the cranium and lower jaws of the leptorhine species, have greatly contributed.

The upper molars from Clacton consist of the last and penultimate ones of the left side, and the ante-penultimate molar of the right side. If this tooth (fig. 141) be compared with the upper molar of the *Rhinoceros tichorhinus*

(fig. 122), which has been worn down to about the same degree, it will be seen that, in fig. 141, the valley, *b*, is wider at its commencement, and that the termination, where the letter is placed, is smaller and of a triangular

Fig. 141.

5th upper molar, *Rh. leptorhinus.* Nat. size. Clacton.

form: in the tichorhine molar it is much more expanded and bilobed by its extension towards the middle of the outer surface of the crown. The valley between these two terminal divisions, in the tichorhine molar, is so shallow, that the outer lobe is soon separated as an island of enamel, according to the pattern shown in fig. 126, and the valley then preserves an almost uniform width to the termination marked by the letter *b*. In the upper molar of the leptorhine Rhinoceros, the valley is either divided by the wearing away of the shallow fold of enamel between the end of the narrow process entering the valley and the opposite bank, *e*, whereby the end of the valley, *b*, is wholly insulated, which change is shown in the molar of the *Rhinoceros leptorhinus*, from Crozes,

Department du Gard, figured, but not recognized as such, in the 'Ossemens Fossiles,' tom. ii., pt. 1, Rhinoceros, pl. xiii., fig. 4; or the whole valley is gradually diminished in depth, without the separation of an enamel-island, but continuing to manifest its characteristic wide beginning, as is shown in the upper molar from the same locality in France, figured by Cuvier, tom. cit. pl. xiii., fig. 5. These varieties depend on the varying depth of the narrow part of the valley at the end of the small intruding promontory, and they are exemplified in two of the molars from Clacton: but neither of the patterns of the grinding surface of the upper molars of the *Rh. leptorhinus*, produced by the effects of mastication upon the valley, *b*, are presented by the molars of any of the recent Rhinoceroses, except the two-horned species of Sumatra. In this the valley, *b*, very closely resembles in its form and intruding promontory that in the upper molars of the leptorhine Rhinoceros; but the ridge on the outer side of the tooth, corresponding to that marked *d'* in fig. 141, is much more produced, and the adjoining convexity at the middle of the outer surface is flatter.

But to proceed with the comparison between the upper molars of the extinct tichorhine and leptorhine Rhinoceroses; the lateral valley, *a*, is wider and deeper at its commencement, and shallower at its termination in fig. 141 than in figs. 122 and 126; it is not so soon, therefore, worn down into a second island of enamel, like that shown in the molars of the tichorhine Rhinoceros figured by Cuvier, loc. cit., pl. xiii., figs. 1 and 6: the inner termination of the lobe, *c*, is broader and more bulging in the leptorhine Rhinoceros, the outer longitudinal ridge, *d'*, is more produced, and the anterior basal ridge, *f*, is longer and better developed. The small

tubercle, *m*, is commonly, but not constantly present at the entry of the valley, *b*. I have never seen it in an upper molar of the tichorhine Rhinoceros.

Professor Jäger has figured an upper molar tooth from the opposite side of the jaw to that in fig. 141, in the Second Part of his 'Fossilen Sæuge-thiere Würtembergs,' fol., 1839, tab. xvi., fig. 31. It was discovered in a sand-pit ("sand-grube") at Kirchberg, in Wirtemberg, and exhibits about the same amount of attrition, the same characteristic form of the principal valley, the anterior basal ridge, the prominent longitudinal ridge (*d'*), and the expanded convex bases of the inner lobes, separated by the wide beginning of the valley, as in the Clacton leptorhine molar. Professor Jäger notices the latter character,* and the little tubercle (*m*) at the base of the valley, which is likewise present in our Clacton leptorhine molars;† but he does not allude to the more important character, which his figure represents, of the simple termination of the valley (*b*).

The zealous investigator of the Wirtemberg Fossils appears not to have perceived the specific resemblance between the molars from Kirchberg and that from Crozes (Gard), figured by Cuvier, tom. cit., pl. xiii., fig. 4. And, as Cuvier had not obtained evidence to connect these specimens with his *Rh. leptorhinus*, nor, indeed, appears to have appreciated their difference from the molars of the tichorhine Rhinoceros,‡ Professor Jäger had no clue to the

* Professor Jäger, after noticing the general resemblance of the fossil tooth with a corresponding one of the African two-horned Rhinoceros, observes, "allein er unterscheidet sich von ihm ausser der Grösse durch die mehrere Rundung und Trennung der innern Abtheilungen, wodurch er sich noch insbesondere von demselben Zahne von Cannstadt, tab. xvi. fig. 10, unterscheidet, so wie durch den kleinen höcker in der Mitte zwischen beiden. p. 180.

† This is more strongly developed in the molar teeth of the *Rhinoceros incisivus* (*Acerotherium*, Kaup). The Constadt tooth above cited is a molar of the *Rh. tichorhinus*, closely agreeing with that from Chartham, fig. 122.

‡ The molar tooth of the tichorhine Rhinoceros, figured in the 'Ossemens

discovery that the molars of the Rhinoceros from Kirchberg belonged to a distinct species which had already received its appropriate name; and he therefore proposes to denominate it "*Rhinoceros Kirchbergense*"* (sic, p. 179).

Dr. Kaup has given a reduced and reversed view of the same molar tooth in his 'Akten der Urwelt,' 8vo., 1841, taf. i., fig. 4; he equally appreciates the distinction of its structure from the corresponding molars of the *Rhinoceros tichorhinus*, and at the same time recognizes its specific identity with the molars from Crozes. The means of identifying it with the *Rh. leptorhinus* were equally wanting to the Palæontologist of Darmstadt, who, notwithstanding a name had been already attached to the species by Professor Jäger, proposes to call it *Rhinoceros Merckii*. The last molar tooth of the left side, which is retained in a portion of the upper jaw from the fresh-water deposits at Clacton, closely resembles the corresponding less worn molar of the right side from Kirchberg, figured by Professor Jäger in the work cited, pl. xvi., fig. 32, and, like it, differs from the corresponding tooth of the *Rh. ticho-*

Fossiles,' tom. ii. pt. 1. pl. vi. fig. 5, in which the enamel island is formed by the insulation of one lobe of the expanded termination of the valley (*b*), is thus described: "On y voit aussi très-bien la fossette, résultant de l'union du crochet postérieur avec la colline antérieure, et l'echancrure postérieure commence à être cernée."—P. 57. The molar tooth of the leptorhine Rhinoceros, figured in pl. xiii. fig. 4, in which the enamel island is due to the insulation of the entire unexpanded end of the valley (*b*), is thus described, "Le trou antérieure y est dejà distinct par l'union du crochet de la colline postérieure avec la colline antérieure, mais l'echancrure postérieure n'y est point encore cernée."—Ib. p. 58.

* The *nomina trivialia*, formed by latinizing German names of individuals or places, grate harshly upon the ear. One regrets the obligation to adopt such a name as *Schleiermacheri* in place of *megarhinus*, but the law of priority is absolute. With regard to names derived from particular localities, they are obnoxious to the graver objection of indicating very partially and imperfectly the geographical range of the extinct species to which they are applied.

rhinus in the relatively thicker and more bulging base of the inner and anterior lobe, in the more even and less undulating surface, which extends from the anterior external to the posterior internal angle of the crown, and in the absence of the infundibular cavity at the posterior angle of the crown.

The only portion of the vertebral column of a Rhinoceros discovered at Clacton was the os sacrum; this bone, by the anchylosis of five vertebræ, and the broad, thick, rough plate of bone extending horizontally from the confluent ends of the spines of the first three vertebræ must have belonged, like the cranium, to a fully mature individual. It is of an almost equilateral triangular form, six inches nine lines across the base, and six inches in length; it differs from the os sacrum of the *Rh. Sumatranus* in the oblique truncation of the lower angles of the transverse processes of the fourth vertebra, and the less elongated form of the articular surfaces on the forepart of those of the first vertebra. I have not had the opportunity of comparing this sacrum with that of the *Rhinoceros tichorhinus;* but it most probably belongs to the same species as the other fossils from the fresh-water deposits at Clacton.

Cuvier, having obtained evidence that a fossil humerus of a *Rhinoceros*, discovered by Professor Nesti in the Val d'Arno, differed from the humerus of the tichorhine Rhinoceros by its longer and more slender proportions, by its longer and less prominent deltoid crest, and by some minor characters, suspected it to belong to the *Rh. leptorhinus.* The association with the unquestionable remains of that species in the fresh-water deposits at Clacton, of a considerable portion of a humerus of a Rhinoceros, participating in all the distinctive features of that from the

Val d'Arno, and closely agreeing with the figures given by Cuvier in the 'Ossemens Fossiles,' Rhinoceros, pl. x., figs. 1 and 2, confirms the accuracy of the reference of the Val d'Arno remains to the *Rhinoceros leptorhinus*. The humerus now before me, discovered by Mr. Brown at the same time and place with the leptorhine cranium, presents a most striking contrast with the proportions of the humerus of the tichorhine Rhinoceros before cited, from Lawford.

I subjoin the following comparative dimensions:

	Rh. leptorhinus.		*Rh. tichorhinus.*	
	In.	Lin.	In.	Lin.
Length, from the head to the beginning of the anconal depression	10	0	10	6
Length of the deltoidal crest	7	3	8	0
Circumference of the proximal end	19	0	26	0
Smallest circumference of the shaft	7	9	10	6
Breadth of the proximal end	7	0	9	6

In Mr. Brown's specimen the distal end is broken off.

An ulna, slightly mutilated, from the till at Walton, near Essex, in like manner agrees in its proportions with that from the Val d'Arno, figured by Cuvier in the plate cited, fig. 13.

The long and slender proportions of the femur of the Italian Rhinoceros are noticed in the 'Ossemens Fossiles;' the third trochanter is thrown more forward, and the great trochanter does not descend to join the third.

I have had no means of applying these characters to the identification of the leptorhine species as an English fossil; the only part of the femur found associated with the skull and teeth of the *Rh. leptorhinus* at Clacton being the distal extremity, on the characters of which the text is silent, and the reduced figures inexpressive in the 'Ossemens Fossiles.' This fragment having been kindly transmitted to me by Mr. Brown, together with the other

specimens of *Rhinoceros leptorhinus* from Clacton, I have compared it with the corresponding part of the femur of a *Rhinoceros tichorhinus*, obtained from the drift near Moscow.

The first and most obvious distinction of the Clacton femur is the narrower, shallower, and more oblique surface of the shaft, immediately above the articular surface for the patella; the convex ridge continued upwards from the internal and more prominent boundary of that surface is broader, more rounded, and more gradually blended with the shaft of the femur; the whole surface exterior to this ridge slopes more suddenly to the outer side of the bone, and there is a much deeper excavation below the rotular articulation. In the femur of the tichorhine Rhinoceros, the transverse exceeds the antero-posterior diameter of the shaft six inches from the lower end; in that of the leptorhine species, these proportions are reversed at the same part of the shaft. The outer side of the femur behind the outer ridge is more concave in the Clacton specimen, which measures, from the fore to the back part of the external condyle, eight inches; it most probably belongs to the leptorhine species.

In Mr. Brown's collection there are specimens of upper molar teeth of the *Rhinoceros leptorhinus* from the till at Walton in Essex. One of these is the last molar, which had just come into use when the animal perished. Another specimen is a third upper molar, worn down to its base. The same Geologist also possesses the germ of the ante-penultimate molar of a *Rhinoceros leptorhinus* from Grays, in Essex, in which many smaller processes are sent off into the principal valley (*b*), in addition to the larger promontory. A similar modification of a superior molar tooth of the leptorhine Rhinoceros from Tuscany

is noticed in the addition to the paragraph on that species in the 8vo. edition of the 'Ossemens Fossiles,' tom. iii., p. 138: I am not disposed, however, to place much stress upon this as a specific character.

Mr. Parkinson appears to have been the first to recognize remains of the Rhinoceros in the formations on the Essex-coast. He says: — "From several fragments of bones, which I met with in the Essex bank, I was led to suppose that the remains of some other very large animal, besides those of the Elephant and Elk, had been there imbedded."—'Organic Remains,' vol. iii. p. 371. The upper part of an os femoris, which differed from that of any animal with whose skeleton Mr. Parkinson was acquainted, induced him to be more particular in his research, and led to his discovery of the tooth of the Rhinoceros, which he has represented in Plate xxi. fig. 3. (op. cit. p. 372.) "This tooth," he proceeds to say, "is an upper molar of the left side, is pretty much worn, and must have belonged to a small animal, since it is not one half the size of the teeth which are found at Chartham." The figure shows all the essential characters of the upper molars of the *Rhinoceros leptorhinus*.

A part of a fossil lower jaw, discovered in the tertiary marine deposits of Monte Blancano, near Bologna, which had obtained notoriety through Professor Monti's description of it, in 1719, as part of the skull of a Morse, was not only proved by Cuvier to be part of a Rhinoceros, but the great Anatomist congratulated himself on being able to determine, by the prominent symphysis, that it had belonged to the *Rhinoceros tichorhinus*. "This discovery," he remarks, "is one of great importance, since it shows that the two species" (the tichorhine and leptorhine) "had inhabited Italy," op. cit. p. 143.

The identification of the fossil teeth respectively referred, in the works of Cuvier, Jäger, and Kaup, to the *Rh. tichorhinus*, *Kirchbergensis*, and *Merckii*, with the *Rh. leptorhinus*, demonstrates a further range of that species, which we now know to have been associated with *Rh. tichorhinus* in France, in Germany, and also, by the instructive specimens obtained by Mr. Brown, in our own island.

Mr. Fitch of Norwich possesses specimens of upper and lower molar teeth of the *Rh. leptorhinus* from the fresh-water (lignite) beds on the Norfolk coast near Cromer, which demonstrate the occurrence of this species in the same deposit with the *Rh. tichorhinus*.

I have not, hitherto, met with any specimens of the *Rhinoceros leptorhinus* from the ossiferous caves of England, nor does the species appear to have extended its range to Siberia, where the tichorhine Rhinoceros most abounded. In this country, as in Wirtemberg, Darmstadt, Central France, and Italy, the remains of the leptorhine Rhinoceros have been left in tranquil deposits of fresh-water lakes or rivers.

Mr. Brown informs me, that at Clacton these deposits line a basin of the London clay, upon which they immediately rest. The deepest part of the basin is twenty feet below the surface, and is covered by a stratum about six inches thick, of red sand, with marine and fresh-water shells; above this, by a deposit five feet thick of peaty matter, with interrupted beds containing marine and fresh-water shells: above this is another thin layer of red sand, with marine and fresh-water shells; then comes another bed of peaty matter four feet thick, overlaid by a thin bed of red sand, with fresh-water shells; and this is covered by a stratum of flinty gravel, four to five feet thick, which supports the

superficial vegetable mould. The remains of the Rhinoceroses, with associated Mammoths and Aurochs, were discovered in the deepest part of the basin; but in the space of three hundred yards towards the north, it rises to the surface and is capped by the gravel. Mr. Brown, in concluding his account of the ancient lacustrine basin, which formed the grave of the huge pachyderms and ruminants that once roamed upon its banks, or wallowed in its muddy shallows, says, "As the bones and teeth which I have now much pleasure in sending you, were all collected by myself, I can vouch for their being marked correctly, as to locality."

The habits of the less robust and less formidably armed species no doubt differed from those of the tichorhine Rhinoceros, which is more extensively distributed over England; some Naturalists have recognized different habits in the three or four species of Rhinoceros now living in Africa, and which differ from each other in form and structure much less than did the extinct leptorhine and tichorhine Rhinoceroses of Europe.

Although the number of species, now extinct, which ranged over the Europæo-Asiatic continent equalled or surpassed that of the existing species of *Rhinoceros*, no fossil remains referable to this genus have ever been discovered in America or Australia. This peculiar form of horned Pachyderm appears to have been confined, from its first introduction into our planet, to the same great natural division of the dry land—the Old World of the geographers—to which the existing representatives of that form are still peculiar.