

XI. *Description of some Species of the extinct Genus Nesodon, with Remarks on the primary Group (Toxodontia) of Hoofed Quadrupeds, to which that Genus is referable. By Professor OWEN, F.R.S. &c.*

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THE application of part of the Government Grant, allotted to procuring drawings of rare and nondescript fossil remains, has furnished the requisite illustrations of the following Memoir on some extinct Herbivorous animals, which indicate a primary group of the *Ungulata*, distinct from and probably equivalent to one of the great divisions called *Proboscidea*, *Artiodactyla*, and *Perissodactyla*.

GENUS NESODON*, O.

The genus so called, from most of the enamel-folds penetrating the crown of the molars being, when exposed by use, of an insular form, was founded by me in 1846†, on portions of an upper and lower jaw, with teeth, transmitted by Captain SULIVAN, R.N., from the S.W. coast of Patagonia.

I have since received from the same zealous contributor of materials towards the advancement of our knowledge of the ancient zoology of South America, more extensive portions of both upper and lower jaws with teeth of the generic character of *Nesodon*, but belonging to a smaller species than that of which the first described specimens formed part; the second collection also contained detached teeth, indicating much larger species than either of the two above indicated.

I propose to commence with the description of the remains of the smaller species, which from its size may be termed—

Nesodon ovinus, Plates XV. and XVI.

With the upper jaw of this species (figs. 1–5) are preserved the articular surface (figs. 1 and 3, *g*) for the right ramus of the lower jaw, the zygomatic arch (figs. 1 and 2, ²⁶ and ²⁷) and part of the nasal bones (figs. 1 and 2, ¹⁵).

The total length of this portion of skull from the post-glenoid process‡ (figs. 1 and 3, *pg*) to the anterior incisor (fig. 1, *di*) is 6 inches 4 lines. The breadth of the

* *νησος* insula, *ὀδὸς* dens.

† Abstracts of Papers in 'Reports of the British Association' for 1846, vol. xvi. p. 66.

‡ The process, sometimes much developed, as in the Rhinoceros, *e.g.*, is so called in my Catalogue of the Osteology in the Mus. Coll. Chir., which answers to the part described as the "middle root of the zygoma" in Anthropotomy (Bourguery, *Traité Complet de l'Anatomie de l'Homme*, tom. 1^{re}, plate 23, fig. 10, *c.*)

glenoid cavity is 1 inch 4 lines. It is slightly concave from side to side, slightly convex from behind forwards, where it forms the 'eminencia articularis' (fig. 3, *g*), which is about 3 lines in antero-posterior extent at its middle, widening to twice that dimension at the outer and the inner ends of the eminence. The narrower concavity behind this part is bounded behind by the thick process (*pg*), extending a little below the level of the outer end of the eminencia articularis, convex anteriorly and below, concave behind, into which deep concavity a venous canal or sinus appears to have opened.

The sutural surface on the inner side of the squamosal (fig. 3, *27*), for junction with the alisphenoid and tympanic, extends from the eminencia articularis (*g*) to the lower end of the post-glenoid process (*pg*), behind which the broken surface of the back part of the squamosal shows part of a smooth cavity.

The zygoma (fig. 1, *26*, *27*) is deep and strong, bent from behind forwards in a gentle sigmoid curve, first convex upwards, then more deeply concave to form the lower part of the orbit, very slightly arched outwards, and formed by the squamosal (*27*) and malar (*26*) in almost equal shares, the major part of the suture between them describing a strong curve, convex forwards. The zygoma is thickest at its two extremities, and of least vertical extent near its anterior one, where it forms the orbit (fig. 1, *o*). There is no trace of post-orbital process from either the malar or squamosal parts of the zygoma, nor of any sutural surface for a descending post-orbital process, as in the Horse. The orbit communicates as extensively with the temporal fossa as in the Tapir and Rhinoceros. The maxillary bone (fig. 1, *21*) sends backwards a plate along the inner side of the fore-part of the zygoma, which unites by a squamous suture with the malar; the malar terminates forwards, gradually contracting as it ascends, at about the middle of the anterior boundary of the orbit, whence it extends but a very short way upon the face. The articular surface for the lacrymal bone may be seen upon the conjoined orbital portions of the malar and maxillary, but the lacrymal itself is lost: its extent upon the face must have been as trifling as that in the Hyrax. The facial part of the maxillary is lofty but not long, gradually decreasing in depth to its anterior border, which is nearly vertical, measuring 1 inch 4 lines in that extent, and wholly united to the pre-maxillary. The outer facial surface of the subquadrate facial plate of the maxillary is concave, and perforated by the antorbital canal (*s*), which opens 6 lines in advance of the orbital border of the maxillary, and 13 lines from the suture with the premaxillary. There is a second small foramen in advance of the large ant-orbital one. The palatal plate (fig. 3, *21*) of the maxillary extends backwards beyond the alveolus of the last molar tooth in place, where its breadth is equal to that at the fore-part of the plate, viz. 5 lines: the plate is 10 lines broad at the middle of its extent, where it forms the anterior end of the oblique rough suture (ib. *20*) for the palatine. The palatines are lost in the specimen; they appear to have formed the middle two-fourths of the produced back part of the bony palate.

The extent of the suture of one maxillary with the opposite maxillary is 2 inches, and behind this the extent of the suture of the maxillary with the palatine is 1 inch: at this part the bone gains much in depth. The palatal plate of the maxillary slopes from the alveolar border towards the median suture, with a curve concave downwards, giving an arched form to the bony roof of the mouth at its anterior two-thirds, behind which the bony palate is less concave transversely, and is convex longitudinally. The post-palatal canal opens obliquely forwards by a foramen situated a little in advance of the middle of the palatal plate of the maxillary a little behind the interval between the third (d_2) and fourth (d_3) teeth in the present specimen. The vacuity behind the maxillo-palatal plates, which was filled up by the palatines, is of a nearly equilateral triangular form.

The premaxillaries (figs. 1, 3 and 4, ²²) are short in proportion to their height, are of a subquadrate form, with the part containing the mid-incisor, i_1 , bent rather abruptly inwards to join its fellow below the nostril, the face being terminated by an obtuse broad muzzle. The right premaxillary is most entire; it is a little dislocated outwards, and has been separated about 4 lines from its fellow, and to a less degree from the maxillary of its own side. The upper border, which joined the nasal (¹⁵), is 9 lines in extent; that which joined the maxillary (²¹) is 1 inch 4 lines; that which joined its fellow (²²) is 10 lines. The palatal plate (fig. 3, ²²) is obliquely grooved by the prepalatal or incisive foramina, the thin inner parietes of which have been broken away.

The portion of the nasal bones preserved (figs. 1 and 2, ¹⁵) show them to have been long and rather broad, meeting above and bent, so as to form an arch: they formed, with the premaxillaries, the external bony aperture of the nostrils, the maxillaries being excluded.

The lower jaw (mandible, Plate XVI. fig. 6) is remarkable for the great proportion which the ascending ramus bears to the horizontal one. The part of the condyle preserved shows it to have been transversely extended and rather convex; the coronoid process rose above its level, and is separated from it by a deep emargination. The entry to the dental canal is 2 inches 2 lines below the condyle. From the condyle to the lower border of the ramus beneath the last molar tooth in place measures 4 inches; from the same part of the lower border to the socket of the outer incisor is 2 inches 9 lines, the depth of the ramus at the same part is 1 inch 4 lines. There is a faint linear impression along the part of the lower border which is preserved. The incisive part of the mandible slightly expands; the outer surface of the horizontal ramus is, lengthwise, convex at its posterior two-thirds, and concave in the rest.

The teeth preserved in the present specimen of *Nesodon ovinus* are,—three incisors, a canine, and five molars on the right side, upper jaw; the canine and five molars on the left side, upper jaw; and the outer incisor, the canine and five molars in the right ramus of the lower jaw.

The upper incisors, unequivocally defined by their position in the premaxillary bone,

diminish from the first (innermost) to the third, and vary more in form than size. The first (figs. 1 and 4, i_1) is curved, with the convexity foremost; the fang is slender and contracts as it penetrates the bone; the crown expands and presents the true trenchant incisive form, is flattened transversely at the fore-part, and slightly convex at the back, with the edge worn flat, but with a slightly raised thin enamel ridge. The second incisor (ib. i_2) does not quite touch the first; its crown is curved, with the most prominent convexity at its fore-part, but it is narrower than in the first, and is three-sided, the outer and hinder facets being broader than the front one. The enamel is not continued upon the hinder facet: the contracted fang shows it to be, like the first incisor, a tooth of restricted growth. It is inserted at the angle of the premaxillary, where the front wall bends to form the side wall, and is external and a little posterior to the first incisor. The third incisor (ib. i_3) is double its own breadth's distance from the second, and is implanted behind it, close to the suture with the maxillary; the crown is short, subtriangular, and so much smaller than the others, as almost to be termed rudimentary; it is, however, worn obliquely, like the crown of the second incisor.

The canine (figs. 1, dc and 3, c) is intermediate in size between the third and second incisors; it is implanted near the suture: the summit of its crown, which was conical and subcompressed, is worn away; its outer side presents a middle convexity bounded by a narrow longitudinal channel near each margin.

The first grinder (ib. d_1) is about the size of the second incisor, and is $1\frac{1}{2}$ line distant from the canine; its crown is thicker as well as broader and longer than that of the canine; the external convexity is produced into a longitudinal ridge near the fore-part of the crown, and its summit forms the most prominent part of the grinding surface, which surface slopes away both forwards and backwards from it, the hinder worn facet being much the largest. The base of the crown contracts and divides into two short nearly parallel fangs. The entire length of the tooth is 7 lines.

The second grinder (ib. d_2), of nearly twice the size of the first, close behind which it is placed, presents two longitudinal ridges dividing three grooves on its outer surface, and a triradiate termination of an inflected fold of enamel at the middle of the grinding surface. The length (vertical diameter) of the crown is 5 lines, and it is implanted by short diverging fangs, two of which are external, and are exposed in Plate XVI. fig. 5, d_2 ; the total length of this tooth is $7\frac{1}{2}$ lines.

The third grinder (d_3 , figs. 1, 3, 5) presents somewhat more than a proportional increase over the second, the hind fourth of which it overlaps, its breadth being $6\frac{1}{2}$ lines. The anterior of the two longitudinal eminences on the outer side of the crown is more prominent and angular than the second convexity which has begun to expand and subside, and the anterior overlapping border of the crown is compressed and produced like a ridge. A fold of enamel penetrates the middle of the inner side of the crown, dips into its substance, contracts as it proceeds outwards and forwards, and bifurcates; behind this there is a small pit or island of enamel:

the postero-external angle of the crown is slightly produced; the increase in the size of the crown is chiefly in its antero-posterior extent and length, which latter is $7\frac{1}{2}$ lines before it divides into fangs, two of which are external, short and divergent. The total length of this tooth is 10 lines.

The fourth grinder (ib. *d*₄), presents an increase of size in the same directions as the third was enlarged, but to a minor degree in antero-posterior extent than in length, in proportion to which the crown is narrow transversely at its grinding surface. The posterior external longitudinal eminence has much subsided, and has lost all the character of a ridge; the anterior external longitudinal ridge continues to be angular and well-marked; it is near the similarly produced ridge-like anterior angle of the crown, which projects outwards, in advance of the hind part of the third grinder. The bifurcating internal enamel-fold penetrates the anterior half of the grinding surface; a second wide simple fold, parallel with the first, answers, in this less worn tooth, to the enamel island in the third grinder; the postero-external angle is more produced than in that tooth. The length of the crown is 1 inch, following its curvature, which is now well-marked, and one-half of the crown penetrates the substance of the maxillary, contracting before it divides into fangs, two of which are external, short and divergent; the entire length of the tooth is 1 inch 5 lines.

The crown of the fifth molar (ib. *m*₁) had but recently begun to protrude from its socket, and is only abraded at the anterior half of the grinding surface. The branches of the forked enamel-fold appear as two distinct folds, and there is a slight depression behind the beginning of the main fold. In the hinder lobe of the tooth there is a wide fold on the inner side, and a depression at its end, which would give rise to an island of enamel at a certain stage of abrasion of the crown. The thickness of the exposed and worn surface of this grinder does not exceed that of the preceding tooth; the breadth or antero-posterior extent is a little greater; but the length of the crown, which is imbedded in the jaw-bone, is considerably greater; it measures, following the outer convexity, 1 inch 8 lines, increasing in thickness, and slightly diminishing in breadth, and terminating in a wide pulp-cavity, without trace of fangs. The ridge-like anterior angle is produced external to, and in advance of, the fourth grinder, in the same imbricated manner as the fourth overlaps the third grinder, and this the second.

In the lower jaw the only incisor remaining (Plate XVI. fig. 6, *i*₃) is that answering to the third in the upper jaw; but it is double the size of that tooth; the crown has the usual trenchant incisive form convex externally, slightly concave on the opposite surface, with a long, straight fang, contracting as it sinks in the socket.

The canine (ib. *c*) is somewhat less, with the crown similarly compressed, but with its worn margin more angular than in *i*₃.

The first molar (ib. *d*₁) much resembles the canine, but is somewhat larger, and the longitudinal convexity and depressions of its inner surface are more marked; its root is single and contracted like that of the canine.

The second molar (ib. d_2) has been markedly larger than the first, but is too mutilated for description; it was implanted by two fangs.

The third molar (ib. d_3), of still increasing size, and chiefly in antero-posterior extent, presents a long compressed crown, divided into two lobes, convex externally, by an oblique, unequal-sided longitudinal angular indentation: the inner side of the hinder and larger lobe is penetrated by two folds, extending obliquely outwards and forwards, fig. 8, d_3 .

The fourth molar (ib. d_4), with a slight increase of antero-posterior extent, has its anterior lobe indented internally.

The crown of the fifth molar (ib. m_1) resembles that of the fourth in configuration and size, but is narrower, from having been less worn. The grinders are placed close together one behind another, in a straight line and a little overlapping.

All the teeth present a deep brown, in some parts almost black, colour, with a polished shining surface. The enamel is remarkably thin, and is closely blended with the dentine, which renders it very difficult to determine its extent upon the exterior of the crown: it appears to be continued much further upon the outer than the inner side of the tooth.

The incisors and canines being indicated by their position, there remained then to determine the nature of the five grinding teeth in place, on each side of both jaws. That this was not the entire number characterising the dental formula of the animal, was shown by the germ of a molar (Plate XVI. fig. 5, m_2) in the fractured hinder protuberance of the maxillary, behind the last grinder in place, the crown of which (ib. m_1) had very recently emerged from the socket.

To obtain further insight into that formula—so important in the elucidation of the true generic character and affinities of the *Nesodon*—I removed the inner parietes of the sockets of the molars in the right ramus of the lower jaw, and, excavating below the base of the coronoid process, exposed there the germ of a molar (ib. fig. 7, m_2) answering to that forming the sixth (m_2 , fig. 5) in the upper jaw. The third (d_3) and fourth (d_4) grinders were implanted by two long tapering and diverging fangs; but the fifth grinder (m_1) presented a marked difference; its crown being continued undivided, with a slight and gradual diminution in antero-posterior extent, and corresponding increase in transverse thickness, to a level, half an inch lower in the deepening ramus of the jaw, than that of the end of the fangs of the antecedent grinder, d_4 . The middle indentation on the inner side of the crown of the fifth grinder (m_1) gradually terminates 9 lines below the summit, the rest of the inner side of the crown being almost flat: at its base a wide pulp-cavity is exposed (fig. 9, m_1), into which the obtuse conical end of a deeply inflected enamel-fold projects from above, indicating great variety in the pattern of the grinding surface at different stages of abrasion of the crown.

From the difference between the fourth (d_4) and fifth (m_1) grinders, I conclude them to belong to different series of those teeth; and, from the analogy of the times

of their appearance in other *Herbivora*, I regard the fifth tooth in place as the first true molar (m_1 of my dental notation*), the succeeding germ to be the second true molar (m_2), and the preceding four grinders in place as being the deciduous grinders (d_1 to d_4). At the stage of growth here exemplified, with the crown of the first true molar (m_1) only beginning to emerge from its socket, the germs of the vertical successors (premolars) of the deciduous molars could scarcely be expected to be calcified; but the depth of the jaw beneath those molars, and the space provided by their narrow and diverging fangs, indicate a provision for lodging the matrices of successional teeth, and the small cavity in the substance of the jaw (fig. 7, p_4) beneath the fangs of the fourth molar (d_4) is probably the beginning of the formative nidus of its successor, the fourth premolar (p_4).

The small size of the incisors, in comparison with the premaxillary bones, and their scattered disposition therein, indicate them to belong to the deciduous series, to which, also, we must refer the diminutive canine.

The shape, size, disposition and complex structure of the molar teeth prove the present extinct species to be herbivorous, and the number and nature of the teeth exposed indicate it to be ungulate. No herbivorous or other Rodent has canines and six incisors in the upper jaw; and no Mammal of the Order *Bruta* (*Edentata*, Cuv.) has deciduous teeth properly so called, or molars divisible into two kinds. All the herbivorous Marsupials have a single pair of large procumbent incisors, and no canines, in the lower jaw.

In comparing the fragments of skull and the teeth above-described with the corresponding parts of existing *Ungulata*, we find the most numerous and important correspondences to be with those belonging to the order *Perissodactyla*†.

Both upper and lower true molars in the *Nesodon* have very long crowns, indicating the roots to be comparatively short, and formed late, as in the genus *Equus*. The close imbricated disposition of the upper molars and the pattern of the enamel-folds of the crown find their nearest parallel in the *Rhinoceros*.

Both the Tapir and the Horse resemble the *Nesodon* in the number and relative proportions of the incisors and canines. The Tapir, amongst existing *Ungulata*, offers the closest resemblance to the *Nesodon*, in the form and proportions of the zygomatic arch, of the widely communicating orbital and temporal fossæ, and of the articular eminence and cavity for the lower jaw. The premaxillaries join the nasals as in the Horse. The proportions and shape of the post-glenoid process in the *Nesodon* approach more nearly those in the Tapir or Horse, than those in any of the Artiodactyles‡ in which that process is well-developed, as *e. g.* the Peccari and Hippopotamus, in neither of which is the 'eminencia articularis' developed as in the *Nesodon*. The principal osteological character in which the *Nesodon* deviates from the perissodactyle, and seems to approach the artiodactyle, type, is the production of the osseous roof of

* Philosophical Transactions, Part II. 1850, p. 491.

† *Pachydermes à doigts impaires*, CUVIER.

‡ *Pachydermes à doigts paires et Ruminans*, CUVIER.

the mouth backwards as far as, and a little beyond, the last molar in place; but this part of the palate is formed for some extent externally by the maxillary bones (Plate XV. fig. 3, ²¹), whilst in the Artiodactyles it is formed by the palatines, except where a very thin plate of the maxillary completes the socket of the last molar on its inner side.

Neither family nor subordinal correspondence resulting from the comparisons with existing *Ungulata*, they were next extended to the extinct forms, and especially to those that had previously been discovered in South America. But not to prolong the description with needless details, I may confine myself to the remark, that, in this inquiry, the nearest resemblance to the *Nesodon* was found to be offered by that hitherto anomalous genus for which I have proposed the name of *Toxodon**.

In the *Toxodon platensis* the bony palate is continued, as in existing Artiodactyles, beyond the molar series; but the proportion of this back part which is contributed by the maxillaries resembles that in the *Nesodon*, and is greater than, and different in form from, that in the Hog-tribe, the Hippopotamus and the Ruminants. The palate is arched in the *Nesodon*, and also, but with a deeper concavity, in the *Toxodon*: the post-palatal canals in both have the same advanced position of their oblique outlets upon the maxillary; in both Perisso- and Artio-dactyles those outlets are close to the maxillo-palatal suture. In the form of the 'cavitas et eminentia articularis,' and of the post-glenoid process, the *Toxodon* more resembles the *Nesodon* than does the Tapir or the Horse: the convex and protuberant front and lower part of the process and the excavation of its back part are repeated in the *Toxodon*. The strong, deep, sigmoidally bent zygoma, and the vertically extended orbit communicating widely behind with the temporal fossa, are characters common to the *Nesodon* and *Toxodon*; but the orbit is relatively wider, the malar bone is narrower, and its post-orbital process less prominent in the smaller extinct South American Herbivore. In the concavity of the outer surface of the deep facial part of the maxillary, and the anterior expansion of the premaxillaries, the *Toxodon* resembles the *Nesodon*; but the most important evidence of their mutual affinity is afforded by the dental system.

The molar series has a similar arrangement in the *Toxodon*, describing a line gently convex externally, the teeth gradually decreasing as they advance, and having the same close-set, imbricated disposition. The length, curvature and deep implantation of the undivided crown of the upper molars of the *Nesodon*, as exemplified in the fifth molar of the specimen described, fig. 5, *m* 1, are important marks of agreement with the upper molars of the *Toxodon*, in which those characters are present in a greater degree. The same molars of the *Toxodon* also present an obvious similarity to those of the *Nesodon* in structure. The enamel is very thin: a deep oblique fold, penetrating from the inner side, divides the crown into two lobes; and a short fold indents the inner side of the hinder lobe. The anterior external angle of the tooth is produced like a ridge to form the overlapping part in the imbricated molar series:

* Zoology of the Voyage of the Beagle, Fossil Mammalia, p. 16, Plates I. to V. 4to, 1840.

there are, also, two longitudinal risings along the outer side of the tooth. The chief differences presented by the *Toxodon* are seen in the simplicity of the enamel-folds, the low and equal development of the two external longitudinal ribs or risings, the relatively narrower grinding surface, and the more evident interruption of the external coat of enamel at the anterior, posterior, and internal parts of the tooth. Moreover, there is no trace of canines or of outer incisors (i_3) in the adult *Toxodon*, and the anterior upper incisors are proportionally very long and large; but the difference might be less in the permanent upper incisors of the *Nesodon*.

The correspondence between the teeth of the lower jaw of the *Toxodon* and *Nesodon* is of the same instructive character. No quadruped, recent or extinct, presents so close a resemblance to the lower molars of the *Toxodon*, in regard to their narrowness, and the length and deep implantation of the straight undivided crown, as does the *Nesodon*, especially in the first true molar, exposed in the section shown in fig. 7, m_1 . The (most probably) deciduous incisors of the same specimen deviate, however, considerably from the peculiar disposition, size, shape and curvature of the six lower incisors in the adult *Toxodon platensis*, and this difference becomes of more importance as illustrative of the generic distinction of the two animals, from the proportions and arrangement of the permanent incisors and canines in the lower jaw of the adult *Nesodon*, first noticed in the 'Reports of the British Association' for 1846 (Transactions of the Sections, p. 66), where the affinity of the *Nesodon* to the *Toxodon* is indicated, and the interval between the latter genus and *Macrauchenia* is stated to be "partly filled by the newly-discovered *Nesodon*."

We may, now, therefore, regard the following as the generic characters of the *Nesodon*:—

Dental formula,— $i \frac{3-3}{3-3}$, $c \frac{1-1}{1-1}$, $p \frac{4-4}{4-4}$, $m \frac{3-3}{3-3}=44$. The teeth subequal, and in an unbroken series. *Incisors* trenchant, with long, slightly curved crowns, but not disproportionately large, and of limited growth, being implanted by a tapering fang: *Canines* smaller, and not exceeding in length the contiguous premolars: *Molars*, above, with long, curved, transversely compressed crowns, which contract, as they penetrate the bone, and ultimately develope fangs: the outer side of the crown ridged, the inner side penetrated by two more or less complex folds of enamel, leaving insular patches on the worn crown: the enamel is deposited in a thin layer. The lower molars with long and straight, transversely compressed crowns, divided by an external longitudinal indent into two unequal lobes, both penetrated at the inner side by a fold of enamel, which is complex in the hinder lobe.

The bony palate entire and extending back beyond the molars, the maxillaries and palatines forming the back part in equal proportions. A distinct articular cavity and eminence for the lower jaw, the eminence long and concave transversely, short and convex longitudinally; a protuberant post-glenoid process; a strong and deep zygoma; the orbit and temporal fossa widely intercommunicating; premaxillaries joining the nasals.

Of the genus offering the above osteological and dental characters, I have already received evidence of four species.

The first is that about the size of the Llama, called *Nesodon imbricatus**, founded on the fore-part of the lower jaw and on two molars of the upper jaw. The second species, of the size of the Zebra, called *Nesodon Sulivani* in honour of its discoverer, is indicated by detached molar teeth of the lower jaw. The species to which the portions of skull above described belonged, seems, from the size of the first and second true molar tooth, to have been about the size of the *Vicugna*, or of a large sheep, and I propose to call it *Nesodon ovinus*. A fourth species, as large as a Rhinoceros, is indicated by an upper molar tooth; and I propose to call it *Nesodon magnus*.

That the specimens on which the species *Nesodon ovinus* is founded, did not belong to a young individual of the *Nesodon imbricatus*, is shown by the difference in the extent occupied by the first four (deciduous?) grinders in the lower jaw, Plate XVI. figs. 6, 7, 8, d_{1-4} ; and in that occupied by the first four grinders (premolars) in the lower jaw of the *Nesodon imbricatus*, Plate XVII. fig. 11, p_{1-4} ; and by the great difference in the size of the teeth, which, on the hypothesis of the two alleged species being one, must hold the relation of temporary and successional teeth. For, assuming, as is most probable, that the first four grinders in the lower jaw of the *Nesodon ovinus* are milk-teeth; yet these are displaced and succeeded vertically by the premolars, which are in most Herbivores smaller and less complex, and in no Mammals larger and more complex, than the teeth they so displace; such premolars never occupying a greater longitudinal extent, although they sometimes, when fewer in number than the deciduous grinders, occupy a less extent, in the jaw of the adult animal. We may therefore safely infer that the four teeth occupying the extent of 3 inches in the lower jaw of the *Nesodon imbricatus*, p_{1-4} , fig. 11, could not have risen into the place of the four molars, which only occupy the space of 1 inch 9 lines in that of the *Nesodon ovinus*, d_{1-4} , fig. 6.

If, next, we compare the crown of the first true molar in the upper jaw of the *Nesodon ovinus* (fig. 3, m_1) with either of those (fig. 10) referred in my former Memoir† to the *Nesodon imbricatus*, we shall obtain equally conclusive evidence that they have not belonged to the same species.

Upper Molar Teeth of NESODON IMBRICATUS.

The antero-posterior extent of the crown of m_1 in the *Nesodon ovinus* is 9 lines; in the *Nesodon imbricatus* it is 15 lines; the greatest transverse diameter of m_1 in *N. ovinus* is 5 lines; in *N. imbricatus* it is 9 lines. The generic conformity of the shape of the crown and the disposition of the enamel is very close. Both the upper molars (Plate XVII. fig. 10) referred to the *Nesodon imbricatus* have been much worn, the anterior one, of course, the most. In this tooth the posterior division of the forked

* Reports of the British Association, 1846, p. 66.

† *Loc. cit.* p. 67.

fold, *a*, is obliterated except at its end, which forms the enamel-island *b*, fig. 10, and the deep termination of the second fold forms the second island, *c*, which is separated from the rest of the fold, which also forms an island, *d*.

In the next molar, the deep beginning of the second fold, *d*, still communicates with the enamel covering the inner side of the molar: the two branches of the forked fold, *a*, retain the continuity with the main stem, and the only island is that (*c*) formed by the sunken end of the second fold. On the implanted side of the crown of the first molar the obtuse blind ends of both folds project into the bottom of the pulp-cavity of the crown, from which the beginnings of short roots are seen to diverge. The bases of the two folds are seen to be more distinct in the wider pulp-cavity of the second and less worn tooth. The crowns of both teeth have had the same curved form as in the *Nesodon ovinus*; but the greater part has been worn away.

Part of the Lower Jaw and some Teeth of the NESODON IMBRICATUS.

The fossil which originally indicated the genus, and was referred to the species *imbricatus**, consists of the symphysis and part of the right ramus of the lower jaw (Plate XVII. figs. 11, 12, 13, 14). The symphysis is obliterated by complete confluence of the rami at that part; it is rounded anteriorly and slopes downwards and backwards at an angle of 120° with the lower border of the rami; these are slightly concave along the outer walls of the sockets of the anterior premolars, as if the rami had been gently pressed together at that part, in advance of which the symphysis slightly expands before forming the convex termination supporting the incisors.

These teeth (*i*_{1, 2, 3}, figs. 11, 12, 14) incline forwards at the same angle as the symphysis, and increase in size from the first to the third; the summits of the crowns have been worn to an almost flat elongated oval or crescentic surface, from 1½ to 2 lines in the smaller diameter. Those of the first pair (*i*₁) are in contact, the contracting bases slightly diverging to their insertion, which is by a long and slender fang; the length of the enamelled crown is 8 lines, the breadth at the worn summit 4½ lines; this is thickest at the inner border, when the thickness so increases towards the fang as to give a three-sided figure to the transverse section of the base of the crown: the length of the fang is 1 inch, fig. 12.

The second incisor (*i*₂) is situated partly behind and to the outer side of the first, so that the mesial angle of the crown is overlapped anteriorly by the outer angle of that of the first incisor. The crown of the second has its anterior surface almost equally divided into two facets, which meet at an angle which marks the extent of the overlapped part of the crown. The posterior surface of the crown is divided unequally, the intervening angle or longitudinal eminence being near the inner rounded border of the crown. This is 9 lines in length, and nearly 6 lines in breadth at the worn surface. The fang contracts as it descends in the socket, and is 1 inch 1 line in length, fig. 12.

* *Loc. cit.* p. 66.

The third incisor (i_3) has the anterior surface turned more outwards, but similarly subequally divided into two facets, the mesial one lying directly behind and upon the second incisor; the posterior surface is more flattened; the inner border is sharper and more produced; the outer angle of the crown is rounded off. The length of the crown is 10 lines, its greatest breadth, which is below the worn end, is $7\frac{1}{2}$ lines; the fang is somewhat shorter and thicker, but contracts, like the others, to its end; its length is 11 lines, fig. 12.

The canine (c) rises and slopes forwards close behind the third incisor; it is of smaller size, with the fore-part of the crown more convex, and unequally divided by a longitudinal eminence nearer its outer border; the posterior surface is concave; the summit is thin, rounded, with the enamel not worn off, although it is on the same level with those of the incisors. The crown is 9 lines long and 6 lines broad, half-way down. The enamel is continued much further down the fore than the back part of the crown in the incisors and canines, and the length of the crown has been taken from the fore-part. The fang of the canine (c , fig. 12) is 7 lines in length.

The first premolar (p_1) rises behind and to the inner side of the canine; the two surfaces of the crown are directed outwards and inwards; the outer surface has its anterior half convex, its posterior half concave; the convex part rests on the concave surface of the canine, and the concave part receives the lower part of the anterior convexity of the second premolar. The working border rises to an obtuse point formed by the summit of the longitudinal prominence dividing the two parts of the outer surface. The inner surface is slightly concave anteriorly. The height or length of the crown is 9 lines, the breadth of the crown is 8 lines. It is implanted by a single, short and thick, moderately tapering, and obtusely ended fang, 6 lines in length (p_1 , fig. 12).

The second premolar (p_2) has the crown divided into two equal lobes by a wide and deep longitudinal angular indentation on its outer surface. The anterior lobe is the most prominent one, and has three sides, the antero-external surface being transversely convex: the postero-external one flat, and the internal surface concave. The inner concavity of the hinder lobe sinks at its lower end into the substance of that lobe. The whole crown is convex vertically on the outside, concave on the inside, being slightly bent inwards in the direction of its length; this measures 10 lines, the breadth is 8 lines: the crown gradually contracts to the fangs (p_2 , fig. 12), which are two in number, and diverge as they penetrate the sockets; their transverse breadth is considerable; their length 6 lines. The anterior one passes external to the fang of the first premolar, which is wedged, as it were, into the internal interspace between the canine and the second premolar.

The third premolar (p_3 , figs. 12 and 14) presents the general complex form and structure characteristic of the true molars. The external entering angle marks off the anterior third of the crown as the anterior lobe, which is convex transversely,

and more prominent than the larger and less convex posterior lobe; it is slightly indented on the inner side. The posterior lobe shows the two islands of enamel *a* and *b*, fig. 14, Plate XVII. on its grinding surface and the terminal fossa (*c*) of the internal longitudinal fold almost reduced to the state of an island. The length of the crown is 9 lines, the breadth (now the antero-posterior extent) is 11 lines, the thickness of the worn surface of the anterior lobe 4 lines.

The crown of the fourth premolar (p_4 , figs. 11 and 14) is 1 inch (12 lines) in breadth, but sinks much deeper in the substance of the jaw before dividing. The narrow curved enamel-fold, answering to the island *a* in p_3 , is seen in the present less-worn tooth to be a fold marking off the hind boundary of the anterior lobe on the inner side of the crown: the circular island (*b*) is repeated; the inner fold (*c*) of the hind lobe is wider. The grinding surface of the fourth premolar does not exceed that of the third in breadth.

Only the anterior lobe of the first true molar (m_1) is preserved; it has been worn down two lines below the level of the last premolar, and the internal depression is wider and deeper than in the premolars. Its length is 1 inch 10 lines, of which more than 1 inch is implanted in the jaw, and it terminates below in a widely open pulp-cavity, fig. 13.

The last three premolars and first true molar are in close apposition, one behind the other in the same line; the anterior surface of one being pressed so close against the back part of the next as to have caused the disappearance of the enamel, if it had been originally laid upon the anterior surface of the crown so worn by pressure.

The part of the jaw here preserved shows it to have been deep and narrow; the hinder half probably resembled in its height that in the *Nesodon ovinus*. Two small foramina on the same horizontal line open upon the outer surface, midway between the upper and lower borders; one of them 1 inch 9 lines behind the anterior end of the symphysis, the other 2 inches 3 lines behind the same part. The antero-posterior extent of the symphysis seems to have been not more than 2 inches.

The breadth of the jaw at the alveoli of the first premolars is 1 inch 8 lines; it becomes wider below, as well as in front and behind those teeth.

The lower molars of the *Toxodon*, in their great length of the undivided crown, their breadth, their thinness, the narrow and prominent anterior lobe, and the broader but thinner and internally penetrated posterior lobe, manifest the same general type of structure, as those above-described, in the *Nesodon*; the generic distinction is seen in the less complex disposition of the enamel.

When the lower jaw and teeth of the *Nesodon imbricatus* are compared with those of the *Nesodon ovinus*, differences present themselves, which can only be referred, in the present state of zoological principles or philosophy, to a distinction of species.

The crown of the outer incisor in *Nesodon ovinus* (Plate XVI. figs. 6 and 8, i_3) is less than half the size of that in *Nesodon imbricatus*, so likewise is the crown of the canine and first grinder; and, supposing these teeth to be the deciduous ones, they

are proportionally much smaller than the same milk-teeth are in comparison with their permanent successors in the Horse or Ruminant. In no existing Herbivore is the crown of the third or fourth premolar longer than that of the third or fourth corresponding milk-teeth; but the antero-posterior extent of the crown of the fourth premolar in *Nesodon imbricatus* equals that of both third and fourth (milk?) molars in the *Nesodon ovinus*.

The difference of the size of the fifth molar (m_1) in *Nesodon ovinus*, compared with the portion of the first true molar (m_1) in *Nesodon imbricatus*, is decisive as to the superior size of that species to the adult of the *Nesodon ovinus*, on the hypothesis that the teeth anterior to m_1 are deciduous in the specimen on which I have founded the latter species.

The summit of the thin but broad crown of m_1 , fig. 7, has but just begun to be abraded in the *Nesodon ovinus*; but the entire extent of the inflected fold of enamel is displayed in the imbedded part of the tooth, which has been exposed at m_1 , figs. 7 and 9, the vertical extent, from the summit of the tooth, being 1 inch 4 lines.

The vertical extent of the part of the first molar (fig. 13, m_1) preserved in the lower jaw of the *Nesodon imbricatus* is 1 inch 10 lines, and the crown continues to expand to the widely open lower termination, which measures 6 lines in thickness, the same diameter of the bottom of the crown of the first molar (m_1) in the *Nesodon ovinus* being 2 lines.

Here, then, we have two species of the extinct genus restored; and the fossils upon which the *Nesodon imbricatus* is founded supply the characters of the permanent teeth which are so singularly clustered in overlapping arrangement, at the fore-part of the lower jaw, whilst the characters of the first or deciduous dentition of the same part of the jaw are illustrated in the more complete fossils that give the characters of the *Nesodon ovinus*.

Lower Molar Teeth of NESODON SULIVANI.

I next proceed to the description of the remains of the third species of the present remarkable genus.

Nesodon Sulivani.—This species, which appears to have been about the size of a Zebra, was founded, in my original Memoir*, on some detached teeth, of which I now subjoin more detailed descriptions, with figures.

Plate XVIII. fig. 15, represents a lower grinder, with the crown worn down, and the root broken away, an equal extent of both parts of the tooth being preserved. The root has been fractured at the part where its two divisions had not begun to separate; but where their proportions are marked out by a median external and internal longitudinal indentation, connected by a line traversing the consolidated substance of the fractured base, and indicating it to consist of two connate fangs. By the equality of the two lobes of the crown, indicated by the external longitudinal

* *Loc. cit.* p. 67.

notch, *n*, this tooth corresponds best with the second premolar (*p* 2) in the lower jaw of the *Nesodon imbricatus*, fig. 11; and, the anterior lobe being indicated by its greater prominence, it is shown to have come from the right ramus of the jaw. The crown has been worn below the part which bears the internal depressions in the *N. imbricatus*; and a smooth field of dentine is exposed, with the indented plate of enamel on the outer side, and a smooth, slightly convex plate of enamel on the inner side, the two plates being interrupted on the anterior and the posterior sides of the crown, due apparently to the unequal degrees in which the enamel was extended towards the fang along different parts of the crown. The outer coat of enamel is thicker than the inner one; and the former best shows the delicate parallel close-set transverse striæ, indicative of the successive formation of that substance; it is also impressed by a transverse row of minute close-set punctations. The fang is enclosed by a thin layer of cement, which is continued upon the parts of the crown undefended by enamel. The hinder lobe is worn lower than the other, as it is also in the *Nesodon imbricatus*. It differs from the tooth of corresponding form in that species, not only in its greater size, as indicated by the dimensions of breadth and thickness, but also by the thicker coat of enamel and the greater length of the undivided root. There is, also, a worn, smoothly excavated surface on the fore-part of the crown, which indicates close contact with an anterior premolar of a different shape from the *p* 1 in the *Nesodon imbricatus*.

The length of the enamelled crown here remaining is 10 lines, its breadth 9 lines, its thickness 6 lines.

A portion of the corresponding tooth of the left side of the same jaw is preserved, in which the bottom of the enamel-fold is still unobliterated, answering to the island, *a*, *p* 2, fig. 14, in the second premolar of the *Nesodon imbricatus*. The length of this fragment is 1 inch 9 lines; its anterior surface shows the same abrasion from pressure against the tooth in advance, and the fractured surface exposes a contracted pulp-cavity in the crown, which becomes obliterated in the fang.

The tooth, Plate XVII. fig. 16, apparently the premolar (*p* 3), succeeding the one last described, is also worn down so near the bottom of the crown, that the inequality of the two lobes appears much less than it would be if the same proportion of the crown had been preserved as in *p* 3 of the *Nesodon imbricatus*; it is probably, therefore, notwithstanding the actual difference in the proportions of the two lobes, the tallying tooth. Of the inflected fold of enamel only the bottom of one remains, forming an island (*a*) in the substance of the grinding surface of the crown, opposite the angle of the fold, *n*, indenting the outer surface of the crown.

The difference in thickness of the outer and inner plates of enamel, which are disconnected at the fore and back parts of the grinding surface, is well-marked, that of the inner plate being less than that of the insular fold, *a*. The inner plate terminates below by a narrow process continued upon the base of each division of the fang. The base of the crown begins to divide above the lower boundary of the outer plate

of enamel, into two almost consolidated fangs, the ends of which are broken off, showing in each the very contracted remnant of the pulp-canal. The enamel is continued 9 lines below the termination of the external groove, is continued a short way down each division of the root, and is characterized by four transverse rows of close-set small circular pits. The length of the enamelled crown is 1 inch 5 lines, its breadth 11 lines, its thickness 8 lines. The tooth above described is from the left side of the jaw; its fellow from the right side is preserved, but in a more mutilated condition.

A tooth, Plate XVII. fig. 17, which, in the unequal size of the two lobes of the crown, tallies with the third and fourth premolars of the *Nesodon imbricatus*, and, by its superior size to fig. 16, answers to the fourth premolar (p_4), has had the complexities of the grinding surface reduced by extensive attrition to the bottom of the deepest of the internal folds, a . It consequently resembles the foregoing tooth (fig. 16), except in its superior size, and in the greater extent of the hinder lobe, which is less convex externally. The outer plate of enamel, below the longitudinal indentation, shows the same coarse and punctate transverse markings. The more regular and delicate striæ of growth are beautifully and clearly shown. The posterior of the two roots, which is the largest, has a narrow central pulp-cavity. The external coat of cement is continued a little way upon the enamelled parts of the crown, and very plainly coats the anterior and posterior tracts where the enamel is interrupted. The length of the remainder of the enamelled crown of this tooth is 2 inches 2 lines, its breadth 1 inch 1 line, its thickness 7 lines.

A portion of tooth (Plate XVII. fig. 18), including the base of the outer lobe of the crown, corresponds in colour, structure and markings with the same part in the foregoing tooth, but is somewhat larger, and has had a much larger crown; it is most probably a part of the succeeding grinder in the same jaw, viz. the first true molar, m_1 . An extent of 1 inch and 6 lines of the outer enamelled part of the outer lobe is preserved, yet the anterior margin of the enamel plate is straight, vertical, and the cement covering the anterior surface of the same shows no trace of abrasion from pressure against the adjoining tooth, as in p_4 , at the same distance above the lower border of the enamel covering the external surface of the anterior lobe. The striæ of growth are as conspicuous upon the enamel of the present tooth (m_1) as in that of p_4 ; and there are two transverse rows of punctations. The lower pointed termination of the internal plate of enamel is preserved at the back part of the fragment; it is 1 inch 4 lines higher than the termination of the enamel on the fore-part of the same tooth.

The tooth, fig. 18, as the reduced size of the enamel-island a demonstrates, has had more of its crown worn away, has been longer in use than the one, fig. 17, which, on the conclusion that it is a premolar (p_4) of the same jaw, must have stood in advance of fig. 18; but, though more worn, what remains of the crown of fig. 18 is longer. The first condition—greater degree of abrasion—accords with the deter-

mination of this tooth as the first true molar, m_1 ; and, if the tallying tooth in the lower jaw of *Nesodon ovinus* be referred to, Plate XVI. fig. 7, m_1 , it will be seen that that tooth would most probably have a longer crown than the successor of d_4 , and would most certainly show a more worn-down summit when the fourth premolar had come into use in advance of it. These evidences of the nature or homology of the fragment of tooth, fig. 18, strengthen my surmise that the teeth (figs. 15–20, Plate XVIII.) are all from the same under jaw.

Plate XVII. fig. 19, is a part of the inner enamelled portion of the crown of a molar 3 inches and a half long, including part of a widely open pulp-cavity at the base, but with an unknown quantity of the worn or exposed end of the crown broken away; it indicates, therefore, a straight, rootless, molar of considerable length; but the character of the enamel accords so closely with that of the better-defined broken teeth above-described, as to indicate it to have belonged to the same genus, species, and, probably, individual, as the other teeth with which it was associated.

The enamel is thinner at its upper broken end than that on the outer side of the above-described teeth of the lower jaw; and it becomes still thinner as it approaches its lower termination. It forms a nearly flat, long plate, terminating by a free, thinned-off border on each side along its lower half, where its breadth is from 8 to 10 lines. The upper half-inch of enamel shows the transverse wavy striæ of growth; the next inch is roughened by the punctate impressions and coarser transverse lines; then the regular striæ of growth are continued for two-thirds of an inch; and again, the punctate character appears for an extent of 3 lines, the alternation of striated and punctated tracts continuing to the irregular rugged termination of the enamel plate. A thin layer of cement covers the outer surface of the lower part of this fragment, which is not plated by the enamel.

Plate XVII. fig. 20, is a similar but smaller portion of a somewhat larger, long and straight tooth, nearly 2 inches in length, and with the enamel-plate 11 lines in breadth, terminating on each side in a thin free border. Both upper and lower ends of this portion have been broken away, the latter above the pulp-cavity; and the enamel and cement here enclose a solid mass of dentine, of a three-sided shape, one of the sides being much narrower than the other two, indicating a long straight tooth, thus in proportion to its breadth. The outer surface of the enamel shows the same alternation of striated and punctated transverse markings as in the preceding fragment.

As the teeth in the portion of jaw of the *Nesodon imbricatus* (Plate XVII. figs. 11–14) are all of the permanent series, the differences in respect of size which they present in comparison with their homologues above-described, are decisive as to their belonging to a smaller variety, if not, as is more probable, to a smaller species. That the degree of distinction is specific, is further indicated by the punctate markings of the enamel, and the more strongly marked striæ of growth; also, by the greater relative thickness of the teeth of the *Nesodon Sulivani*, and by their relatively as well as absolutely

thicker enamel. The outer surface of the anterior lobe of p_2 , and of both lobes of p_3 , is less convex in *Nesodon Sulivani* than in *Nesodon imbricatus*.

Upper Molar Tooth of NESODON MAGNUS.

The superiority of size, indicated by the portion of tooth in Plate XVII. figs. 21, 22 and 23, of the animal to which it belonged, over the *Nesodon Sulivani*, is too considerable to be interpreted as a mere variety in a wild animal. That the dental fragment in question belongs to a species of the present genus, is to be inferred by the close resemblance of the enamelled exterior surface of the tooth to the same part in the upper molars of the known species of *Nesodon*.

This remarkable fragment, which might pardonably have been mistaken for part of the tooth of a Rhinoceros, is the outer side of the crown of an upper molar, worn low down, showing the natural termination of the enamel upon the base of the fangs which, with the inner part of the crown itself, have been broken away.

The remaining part of the crown presents its grinding surface worn obliquely to the enamel, which forms almost a trenchant edge; the produced and ridge-like anterior angle (fig. 23, *a*) is preserved; the longitudinal obtuse ridge of enamel (fig. 21, *b*) on the outside of the crown, near that border, and the gently convex surface of the broad part of the crown behind the ridge, equally repeat the characters of the outer surface of the upper grinders of *Nesodon*, as exemplified in the smaller species (fig. 5, *d* 4). A narrow and low ridge of enamel is continued from the base of the longitudinal rising, *b*, along that of the rest of the crown, 3 or 4 lines from the radical border of enamel, and then curves upwards along the hinder border of the crown to the posterior angle of the outer part of the grinding surface, *c*.

The crowns of the upper molars of the *Nesodon ovinus* do not show this marginal ridge.

The breadth of the remains of the crown of the upper molar of the *Nesodon magnus* at the grinding surface is 2 inches 8 lines; the length of the enamelled part is 2 inches 4 lines. The resemblance of the fragment in its shape, and in the disposition of the outer plate of enamel, to the similarly sized upper molar of the *Rhinoceros* is very close; but the characteristic thinness of the crown, as shown by the bend of the enamel at the fore-part of the fragment, fig. 23, the thinness of the enamel, and the uniform oblique abrasion of the outer part of the grinding surface, are all marks of closer resemblance to the upper molars of the genus *Nesodon*.

The surface of the enamel in the present tooth of *Nesodon magnus* is polished, but is minutely wrinkled, especially towards its basal termination; it shows no striæ of growth.

The remarkable portion of molar tooth here described and figured indicates a species of *Nesodon* of a size equal to that of the largest extinct species of *Rhinoceros*, which genus we may suppose the *Nesodon* to have represented in the American Continent during the pliocene and perhaps miocene periods.

Concluding Remarks.

The osteological characters defining the orders of hoofed quadrupeds, called *Proboscidea*, *Perissodactyla* and *Artiodactyla*, are associated with modifications of the soft parts of such importance, as not only to establish the accuracy of the principles of that ternary division of the great Natural group of *Ungulata**, but to indicate that the known modifications of the skeleton of the extinct *Toxodons* and *Nesodons* of South America, in the degree in which they differ from the osteology of the already defined orders of *Ungulata*, must have been associated with concomitant modifications of other parts of their structure, which would justify, and indeed compel, the consistent classifier to place them in a distinct division of the *Ungulata*, of equal value, if not with the *Perissodactyla* and *Artiodactyla*, at least with the *Proboscidea*. Like the *Proboscidea*, this group, which I propose to call *Toxodontia*, is more nearly allied to the Perisso- than to the Artio-dactyle orders.

This is shown by the large and complex third and fourth premolars (p_3 and p_4), by their close similarity with the true molars, by the unsymmetrical oblique foldings and islands of the enamel, and by the great length of the crowns of the molars, to which the Horse alone offers any near approach amongst existing Ungulates. By the form and proportions of the eminentia articularis, of the glenoid cavity, and of the post-glenoid process,—and by those, also, of the lacrymal bone, of the zygomatic arch, and of the orbit,—the *Toxodontia* are most closely matched by the Tapir and Rhinoceros in the Perissodactyle order.

The dental and osteological characters detailed in the text, whilst they illustrate the closer mutual affinities between the Nesodons and Toxodons, establish their claim to be regarded as types of a distinct order of *Ungulata*; and they also tend to dissipate much of the obscurity supposed to involve the true nature of the genus *Toxodon*, and to reconcile the conflicting opinions as to its proper place in the Mammalian Class.

The fossils above described were discovered on the coast of Patagonia to the south of Port St. Julian, and my friend Mr. CHARLES DARWIN, F.R.S., has kindly communicated to me the following opinion as to the formation in which they were imbedded:—"These beds resemble mineralogically the upper ancient tertiary formation of Patagonia, but EHRENBURG found the included microscopical organisms wholly different from those of the ancient tertiary formation, being of freshwater and brackish origin (p. 117 of my Geological Observations on South America). Hence these beds are of unknown age, probably younger than the old tertiary and older than the superficial beds in which *Macrauchenia* was found."

* Memoir on the Anthracotherioid Animals, in 'Quarterly Journal of the Geological Society,' Nov. 1847, and 'Osteological Catalogue of the Museum of the Royal College of Surgeons,' 4to, p. 629.

DESCRIPTION OF THE PLATES.

PLATE XV.

Nesodon ovinus.

- Fig. 1. Side view of a portion of the skull.
- Fig. 2. Upper view of the same.
- Fig. 3. Under view of the same.
- Fig. 4. Front view of the right premaxillary and incisor teeth.

PLATE XVI.

Nesodon ovinus.

- Fig. 5. Portion of the left upper maxillary bone, with the roots of the teeth exposed.
- Fig. 6. Inside view of the right ramus of the lower jaw.
- Fig. 7. Outline of the same, with the implanted parts of the teeth exposed.
- Fig. 8. Grinding surface of the teeth.
- Fig. 9. Under surface or border of the same ramus.

PLATE XVII.

Nesodon imbricatus.

- Fig. 10. Grinding surface of two molars, right side upper jaw.
- Fig. 11. Part of the right ramus of the lower jaw.
- Fig. 12. Part of the left ramus of the same jaw with the roots of the teeth exposed.
- Fig. 13. Transverse section of the right ramus of the same jaw, showing the implanted part of the anterior lobe of the first true molar.
- Fig. 14. The grinding surface of the teeth in fig. 11.

PLATE XVIII.

- Figs. 15–20. Portions of lower molar teeth of the *Nesodon Sulivani*.
- Figs. 21–23. Portion of an upper molar tooth of the *Nesodon magnus*.
- The figures, letters and symbols, are explained in the text.

Fig. 1.

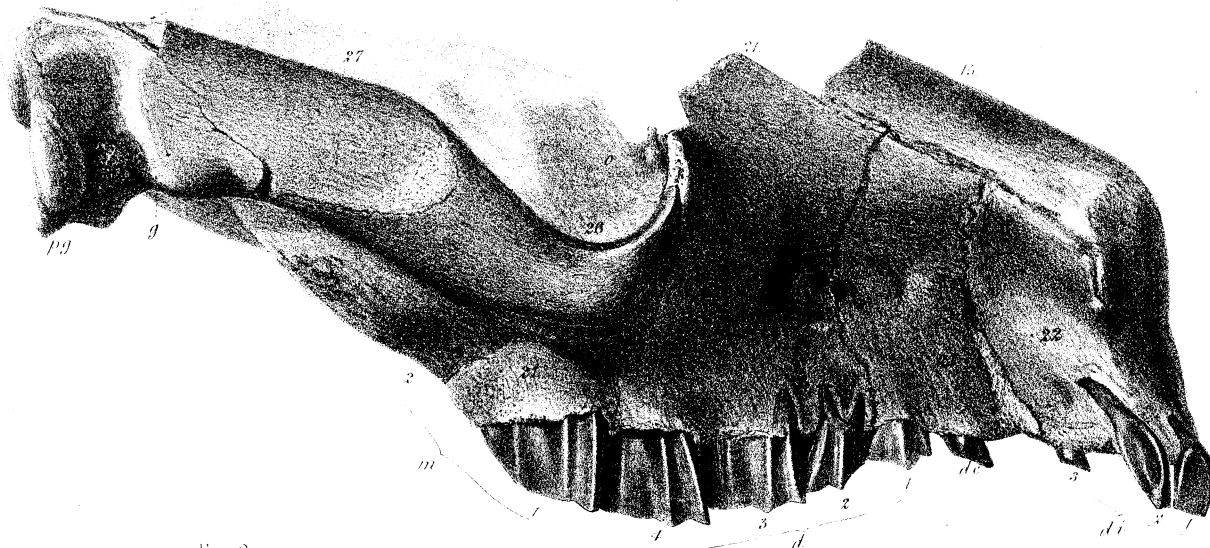


Fig. 2.

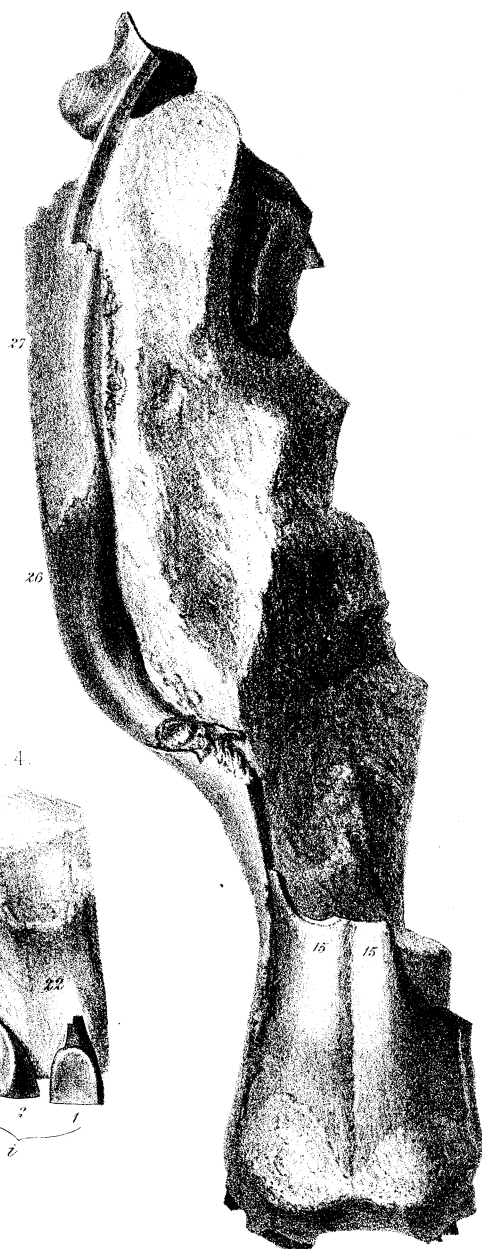


Fig. 3.

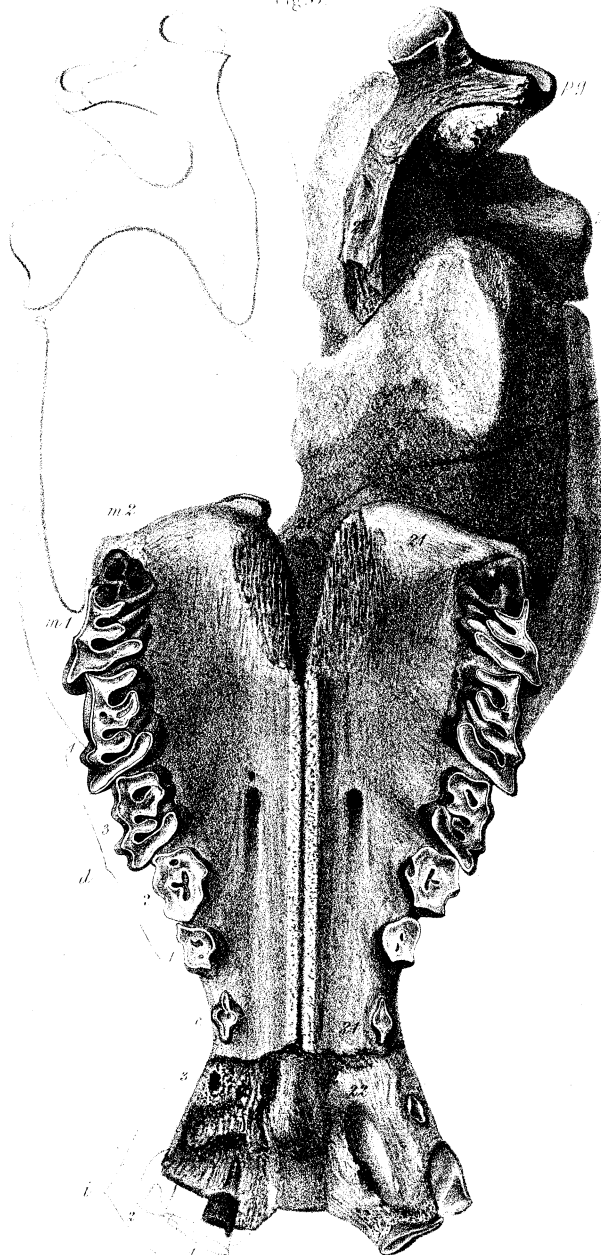


Fig. 4.

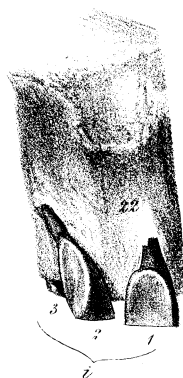


Fig. 5.

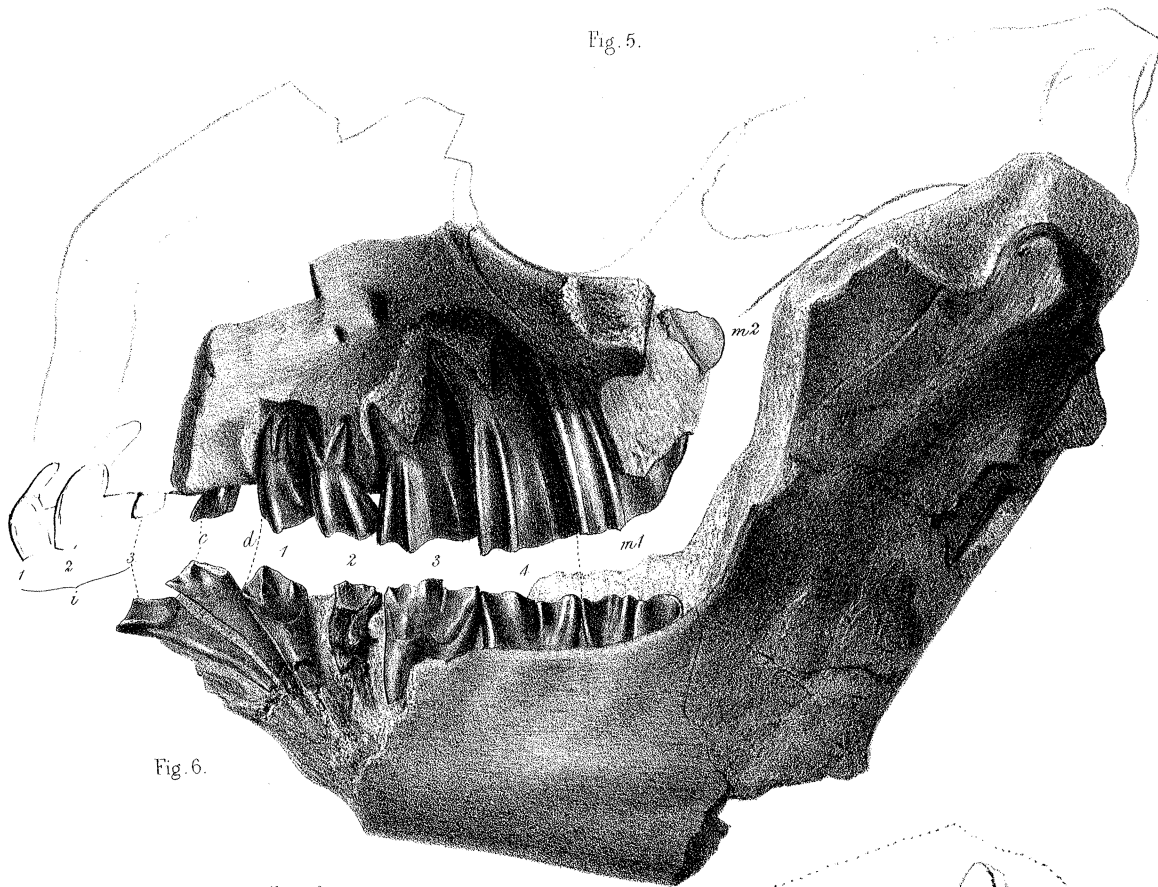


Fig. 6.

Fig. 8.



Fig. 7.

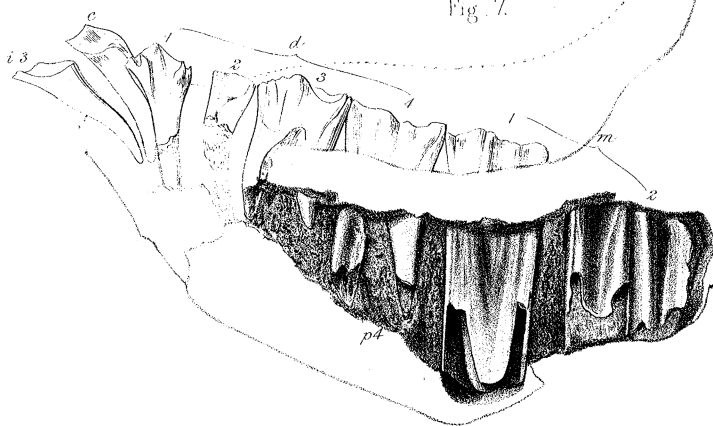


Fig. 9.

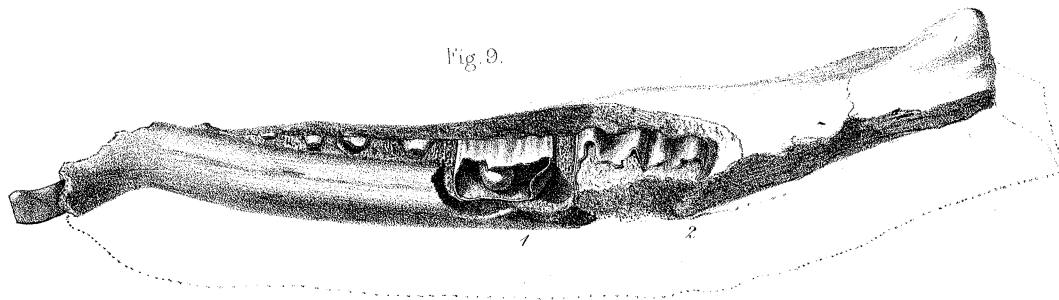


Fig. 10.

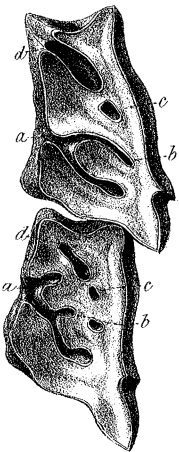


Fig. 13.

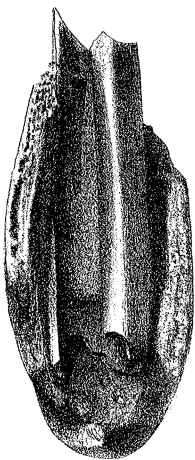


Fig. 11.

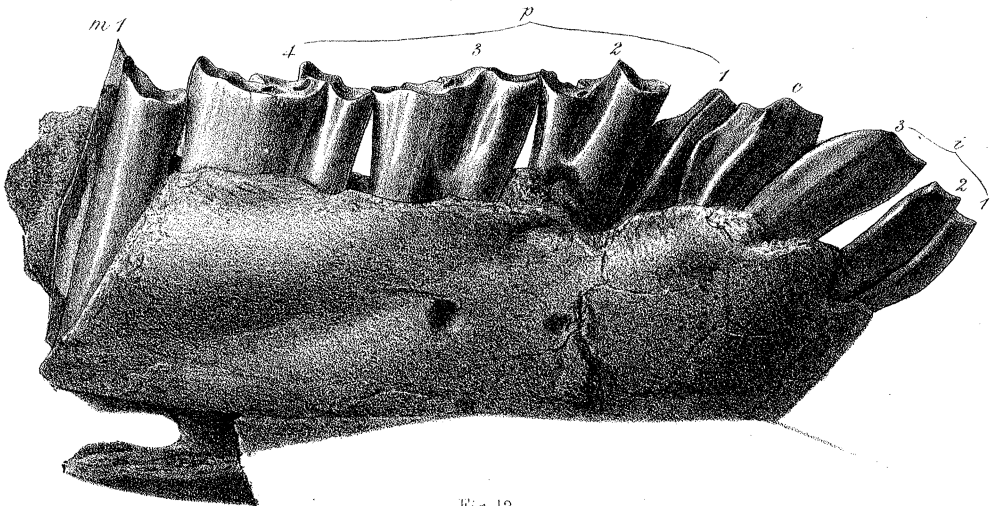


Fig. 12.

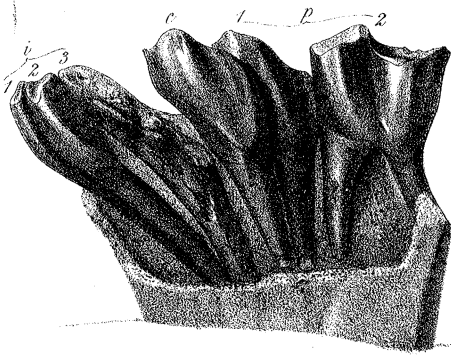
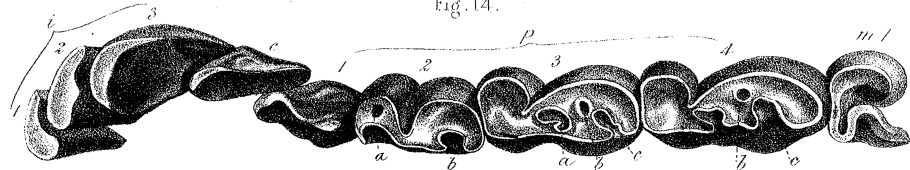


Fig. 14.



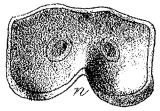


Fig. 15. *p 2, r*

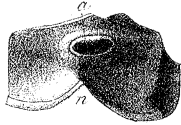


Fig. 16. *p 3, l*

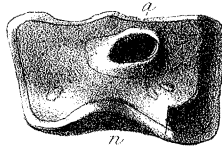


Fig. 17. *p 4, l*

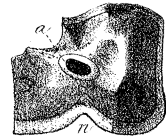


Fig. 18. *m 1, r*



Fig. 19. *m 2.*



m 3.

Fig. 20.

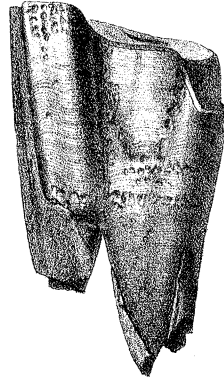


Fig. 21.

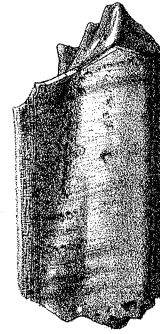


Fig. 22.

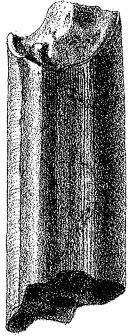


Fig. 23.

