

STUDIES IN TASMANIAN MAMMALS,  
LIVING AND EXTINCT.

Number III.

*Nototherium mitchelli*. \*

Its evolutionary trend—the skull, and such structures as related to the nasal horn.

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Plates XIII. - XXI.

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INTRODUCTION.

In a previous contribution we have traced the history of the Genus *Nototherium*, and have also described the osteology of the cervical vertebræ. As a natural sequence we now desire to place on record certain data gathered from a detailed examination of the skull itself. Before proceeding further, however, it might be as well if we explained our aims as regards the work generally.

A wonderful and most interesting group of marsupial animals has died out in our immediate zoological province, and as the remains available to us are superior in point of preservation to anything obtained in other parts of Australia, we are tempted to pay more attention to phyletic than taxonomic data. If all the *Nototherian* remains in the world were collected to a single centre, many, if not most, of the accepted genera and species would be found unnecessary for their adequate display as a single scientific collection. Accordingly, we are less interested in the ultimate fate of any species than we are in the elucidation of such facts as relate the racial history, development, and extinction of the *Nototherian* stirp. The phyletic trend of the stirp we are investigating was apparently towards the production of an aggressive race, and even a super-

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\* The specimen described was found in the Mowbray Swamp, near Smithton, N.W. Tasmania, in 1920, by Mr. E. C. Lovell. Mr. K. M. Harrisson made an arrangement with Mr. Lovell whereby the specimen was presented to the Tasmanian Museum. Tasmanian scientific institutions have benefited considerably owing to Mr. Harrisson's interest in their welfare.

ficial study of the subject has revealed various osteological parallels, with the similar trend in ungulates, a table of which we hope to supply later on, by way of a recapitulation of the several facts that may be noted in passing. Owing to the imperfection of our knowledge respecting the larger pleistocene mammals of the Genera *Procoptodon*, *Palorchestes*, *Thylacoleo*, etc., it is at present quite impossible to say how fully this combative trend developed before racial extinction became an accomplished fact, but that such mighty creatures (all powerfully clawed), if not otherwise armed, escaped the tendency to aggression, is, to say the least of it, unlikely. A modern Forester Kangaroo (*M. giganteus*), when at bay, is a fearsome beast, and a *Palorchestes*, or a *Procoptodon*, with their extra weight of body and limb, must have been fighting units of no mean order. A little modern Wombat, when stirred up to a pitch of anger, has been seen to bite and lacerate the hand of a child in an exceedingly severe manner, causing one to wonder what a similar performance upon the part of an excited *Phascolonus* would have amounted to! The unenviable reputation of the *Cuscus*s in the alleged circumstances of their predatory instincts, enlarged with a body bulk to that of *Thylacoleo*—although it might not produce the "public executioner" of former disputes, would certainly add its quota to the marsupial battlefield in an effective manner, especially when we remember that the whole construction of *Thylacoleo*, as far as we know it, indicates speed. Manifestly, until the whole history of the pleistocene giants has been worked out from associated bones, rather than—as at present—listed, and cross-listed, from isolated fragments, it will be quite impossible to do more than suggest possibilities; but, if the swamps of Tasmania continue to yield up such evidence as has come to light since the year 1910, the day of exact knowledge should not be a distant one. It has been argued that the *Diprotodon* was as harmless as a *Tapir*, but even *Tapirs* in a captive state have been noted to quite suddenly manifest "fits of irritation, plunging about, lunging "violently with their heads, and snapping with their "teeth"; while in a state of nature, it is said of the American *Tapir*—"when hard pressed it defends itself "vigorously with its teeth, inflicting terrible wounds." As the skull of the *Diprotodon*, according to the late Professor Stirling <sup>(1)</sup>, is still a matter of speculation, in various parts of its osteology, it is obvious that some hitherto unsounded notes are yet to be heard before we can close the octave of that creature's story. Certainly

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(1) Monograph of *Phascolonus*. Roy Soc. S. Aust., 1913, p. 177.

no man upon earth knew more of *Diprotodon* than Doctor Stirling did, so if the skull, *in toto*, was unknown to him, we can with confidence conclude that an uncrushed specimen would reveal new truths to us.

### THE OSTEOLOGY OF THE NASAL PLATFORM.

That the wonderfully supported, and under-propped nasal platform of the *Nototherian* skull was indicative of a nasally implanted weapon, was first suggested by Professor D. M. S. Watson, M.Sc., of the University College, London (2). To the objection that the nasal and cervical regions of *Nototherium tasmanicum* were too weak to have sustained any serious shock, Professor Watson contended that the weapon might have taken the form of a pair of nasal bosses. With the discovery of the skull and parts of the skeleton of *Nototherium mitchelli*, all objections to the former existence of a nasal horn were immediately removed—since the more solidly built cervicals, wider and stronger nasal platform, and manifestly superior deposition of bony matter upon the nasal regions generally, spoke eloquently of the fact. The taxonomists of past days made features of the extent to which the nasal bones covered the nasal aperture, but as will now be shown, except in the most perfectly preserved crania, this character is not to be trusted, since the nasal cartilage was attached to the nasal bones in a manner wholly peculiar, and as we said in our original note, as an obvious adaptation to the special needs of the case. In *Nototherium mitchelli*, the ends of the nasal bones are 25 mm. thick, and upon either side of the middle line the thickness of this bone is first scooped out into a deep fossa, and then filled in with a bony stud, capable of movement within the fossa! A popular illustration of the result thus obtained would be found in the rotation of a bagatelle ball, in its cup-shaped socket upon the board. We can note grades of this adaptation in the following connection:—*Nototherium mitchelli* was a square mouthed animal, but, unlike the square mouthed rhinoceros of today, had front teeth and well-developed fangs. Such fangs, when in use, would need to be set free from the heavy overhanging lip (3), and as the distance between the end of the nose and the base of the horn was a short one, a fixed nasal cartilage would not have permitted of

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(2) *Vide* Monograph of *Nototherium tasmanicum*, page 42, *et seq.*

(3) The extent of this lip may be gathered from the fact that the pre-alveolar extension of the tusks, from that process, to the gum line, amounts to 45 mm., practically a basal attachment for an incipient trunk.

such an action, hence the hinging of the cartilage itself. We do not imagine that any great extent of motion was thus obtainable in actual practice, but enough to give mobility to the upward pull of the ringentes muscles. In animals of the long faced type (to be defined fully later on), the nasals bent downwards, the horn was weak, and for practical purposes, but slightly developed, and so implanted as to leave the nasal cartilage freer from the stiffening effects of its contact with the nasal platform, and the origin of the lip, and accordingly the studs lost most of their motion, and may, in individual cases, have ankylosed up to the walls of their respective fossa, of which we are not without actual proof. The only other instance that we can recall in which the nasal cartilage was possibly attached to the bones by a bony stud is that of the South American *Mylodon*. In that extinct pleistocene giant, the terminal section of the united nasal bones develops a single, central, circular fossa, which, by analogy, suggests a condition similar to that found in *Nototherium*. If the stud existed in *Mylodon*—and apparently it has never been found, as is not to be wondered at if it was as loose as the studs are in the *Nototheria*—it was single and central, and not double and lateral. In Owen's Monograph upon the *Mylodon*, the fossa noted is beautifully shown<sup>(4)</sup>, the appearance being exactly similar to that obtaining in *Nototherian* skulls, when the studs have dropped out. Now a fossil *Nototherian* skull, having once lost its nasal studs, would, with every mutilating movement, suffer attrition of the walls of the fossæ, until the real outline of the tips of the nasal bones would be effectively masked. Taxonomists should note this point! It is known that, irrespective of accidental rending of the horn from its platform, in modern rhinoceroses the horn itself is completely shed, and renewed every six years, and when so shed, animals frequently forget its loss and butt their tender nasal regions in attempting to horn a foe. If the horn was similarly deciduous in the *Nototheria*, they would still have their tusks available during the period of their renewal, and the extra mobility of the lips would serve a special purpose here. Our animal was just reaching the adult stage (as a mass of evidence can prove), and in the full power of its strength it had engaged in a desperate battle with some foe, lost its horn, broke the collar bone in half, shattered one mandibular tusk, and otherwise sustained minor wounds, that eventually led to its death, apparently some weeks later. The period that elapsed between the great fight and the time it actually

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(4) Pl. 5, fig. 3a.

succumbed to its wounds is exactly that required to effect the amount of repair manifested by the broken clavicle, which, by estimation, is only a few weeks at the outside. A very careful examination of the skull and skeleton was made prior to removal from the matrix, especially the skull, and the conviction was formed that the horn had been lost prior to the animal's inclusion into the shallow mud of the old lake floor. Now the horn was an epidermal structure, and just what effect the chemical action of the marcasite and peaty marl would have had upon it is not easy to say, but as seemingly soft wood, in the form of roots of trees, manage to survive, and impress the matrix with their outlines, some little indication of it might have been expected had the weapon remained *in situ*. We most carefully removed all the mud with our hands from the nasal regions (without lifting the skull), and no indication of the fighting weapon rewarded our search, and accordingly we concluded that the horn had been torn from its platform prior to the animal's death. In the modern rhinoceros this also happens, in extreme cases, one instance being cited in which a rhinoceros drove its horn through the side of an elephant, tore the horn off, and both rhinoceros and elephant died.

#### THE NASAL HORN.

If a card of the shape shown in our illustration (fig. 1) is cut out and placed upon the nasal platform of the skull of *Nototherium mitchelli*, it will exactly cover the area that might be presumed to form the attachment surface for the base of the nasal horn. Its central portion would be cut equatorially by the naso-nasal fossa (C), and its right and left frontal aspects, by two nutrient foramina (A, B). Working backwards upon the skull, we discover that the ecto-carotid artery was immense, and prior to sending forward its maxillary branch, gave up some twigs to the vertex, as though to nourish a second, small horn, for which a frontal resting-place exists. After passing the ant-orbital canal, the internal maxillary artery ramified over the face, one portion going to supply the enormous nasal septum and cartilage generally, a second entered the nasal cavity, either in a distinct bony groove, or, in some skulls, more plexiform, over the bony roof of the nose, eventually passing upwards through the naso-nasal fossa to feed the base of the horn. While a third branch, seemingly the homologue of the *lateralis nasi*, went through the lateral groove in the nasal boss, to supply the horn with nourishment, and therefore means of repair.



It is an interesting fact that the horns of existing Rhinoceroses are strengthened and repaired along the front and fronto-lateral surfaces, to compensate for wear and tear, just as in the *Nototheria*, but apparently to a less degree, centrally, than obtained in the horned marsupials. If all the known Rhinoceros horns are passed in review, upon the question of size, ratio of base to height, as well as outline in girth, the card from the nasal platform of *Nototherium mitchelli* would nearest fit the base of an Indian Rhinoceros's horn; and if selection among such horns, upon a ratio of height to base-girth, were made, the height of the *Nototherian* horn would be nine to ten inches. As note—computed girth; deduced from available platform space, fourteen inches, average height of a horn of such girth, nine to ten inches. As some Rhinoceros horns have a distinct cingulum near the base, above which they contract in girth rapidly, this circumstance should be taken note of, also the fact that although practically adult, our *Nototherium* was still a young animal, and the nasal weapon would certainly be shorter than in an old male, who had many times shed and renewed it.

It will be convenient to give here the comparative thicknesses of the nasal bones of the two best-known *Nototherian* skulls, namely, *Nototherium mitchelli* and *Nototherium tasmanicum*, since nothing else short of a comparative examination of the actual skulls themselves will convey to the mind the extra massiveness of *Nototherium mitchelli*.

TABLE OF CALIPERED THICKNESSES OF  
*NOTOTHERIAN* NASAL PLATFORMS.

<i>N. tasmanicum.</i>		<i>N. mitchelli.</i>	
Thickness of right nasal boss .. .. .	} = 42 mm.	Thickness of right nasal boss ... .. .	} = 60 mm.
Thickness of left nasal boss ... .. .	} = 41 "	Thickness of left nasal boss ... .. .	} = 59 "
Central thickness of general nasal platform	} = 21 "	Central thickness of general nasal platform	} = 25 "
Thickness, at base, of nasal cartilage stud*	} = 22 "	Thickness, at base, of nasal cartilage stud	} = 22 "
Thickness of platform midway between the stud and the lateral nasal boss ... .. .	} = 7 "	Thickness of platform midway between the stud and the lateral nasal boss ... .. .	} = 16 "
Width of nasals <i>in toto</i>	= 138 "	Width of nasals <i>in toto</i>	= 175 "

\* In this skull the right stud has fused to the nasal, and is drawn out to a thinness of 17 mm. at the tip.

The female of *N. mitchelli* (Owen's cast, and type skull of *Zygomaturus*), while exceeding all the measurements of *N. tasmanicum*, falls short of those of the assumed male in about the same proportions as usually exist between male and female skulls. Not having the actual skull to work upon, we omit various details, but the cast and a series of photographs, supplied by the Curator of the Australian Museum, are available to us, and a careful study of these leads us to formulate the above statement. As a single note, expressing the rate of reduction, we may cite the widths of the nasal platforms. In the male, the measurement is 175 mm., but in the female this suffers diminution to 150 mm. A glance at the outlines of the implantation surfaces available in the male and female skulls, as given in our figure, will also show that if a horn existed in the female (as apparently it did) it advanced more upon the nasal aperture than that of the male did. In other words, the tips of the nasals were carried nearly across the narial aperture, and the anterior surface of the horn touched the tips of the nasals. This gives an outline for the base of the horn that makes a distinct departure from that obtaining in the male. Such differences in modern Rhinoceroses might also be cited, and where the horn is long, slender, and pointed forward, the females use it to direct the young, the latter being always in advance of the mother when on the march. As long as the female skull of *Nototherium mitchelli* alone remained available for study, the existence of a horn would only have been suggested as a possibility, but the male skull from Smithton carries it forward to the cogency of a proof. Again, *Nototherium tasmanicum*, viewed as an isolated factor, that manifested an elaborately under-dropped nasal platform, too weak to carry an effective fighting weapon, and no excess of cervical power, suggested nothing more than the "fighting bosses"—postulated by Professor Watson—and accordingly it was only with the acquisition of the male skull of *Nototherium mitchelli* that the stirpian homologies determined their full significance. Professor Watson's suggestion is, today, so obviously close to the truth, that it is practically a demonstration of actual fact, and we herewith record our thanks for the strong sidelight thus thrown upon an obscure palæontological point.

It will now be necessary, in order to deal with the question of sex among the *Nototheria*, to show that the type skull of *Zygomaturus* (and Owen's cast) is the female of *N. mitchelli*, and not the sex variant of *Nototherium tasmanicum*, nor is that latter the sex variant of the skull

we call the male of *N. mitchelli*—in a word, *Nototherium mitchelli*, male and female, are quite distinct from *Nototherium tasmanicum*, and as a full table of characters will be given, it is only needful here to investigate the question of the presence and absence of a parietal crest. De Vis made much of this, and it seems a good point to investigate, especially as we can appeal to Kangaroos, Wombats, and Native Bears, among existing marsupials, and to the *Diprotodons*, and the various *Nototheria*, among extinct forms. Exactly what the ancestor of the common group may have shown in the connection we cannot, of course, say, but for a working hypothesis, let us assume a more or less rounded parietal region, with an interparietal bone that formed a section of the calvarium, and divided the parietals upon the median—sagittal—suture.

How, it may be asked, does this fit in with the conditions obtaining in the animals already named?

1. In the Kangaroo, the cranium is rounded, the interparietal, in early life, appears upon the surface, separates the parietals, and throws a dart forward into the sagittal suture. Two muscular lines bound the suture, starting as closely together as 2 mm., and opening outwards to 8 mm. at the frontal suture. At maturity this becomes a bony strip-like platform, slightly elevated above the parietals and frontals.
2. The Wombat starts life with a rounded cranium, a very small interparietal, that early fuses with the supra-occipital, two muscular lines (26 mm. apart, at the occiput, and 35 mm., at the frontal suture) outline the future platform, that characterises the Wombat's skull at maturity.
3. In the Native Bear, the interparietal early fuses with the supra-occipital, but continues to carry forward its full complement of bony matter, dividing the parietals, by its shield-shaped interposition, to a distance of 8 mm., for the first 18 mm. of their journey forward, upon the roof of the skull. Thence forward to the frontals, the parietals develop a sagittal crest (at maturity) and ancestral bounding lines in early life.

In all these, the platform, or the strongly marked crest, as the case may be, is elaborated in the method shown from the ordinary ancestral cranial elements—and a platform never becomes a crest, or a crest a platform, as a sexual modification in the mature animal, whatever slight changes may obtain in early life. Accordingly, the



crested *Nototheria* are made a distinct group of, and not regarded by us as possible sexual skull variations.

To close this comparative study, we must now recall the stages outlined above, and see how they agree with the conditions found in the extinct *Nototheria* and *Diprotodons*.

1. The Kangaroo best agrees with *Diprotodon*.
2. The Wombat's cranial platform is most closely simulated by *Nototherium mitchelli*, in both sexes, to a slightly variant degree. There are, however, traces of the primitive state in which the interparietal is interposed, as in the Kangaroo and Native Bear. This, however, is only visible under a lens.
3. The crest of the Native Bear is found in *Nototherium tasmanicum*, in which skull the whole of the shield-shaped interparietal area has become an open fossa for the implantation of a moiety of the ligamentum nuchæ, and accordingly, the crest arises at the occipito-parietal ridge, as the direct result of the suppression of the interparietal from its true ancestral position, as a moiety of the vertex.

In our section devoted to the taxonomy of the groups, we shall deal fully with the relationships of the several known and recognised *Nototheria*—the present note, however, being osteological, was best interpolated here.

As Professor Owen's description of the *Nototherian* skull covers so much ground, we shall only add such items as his material did not permit of passing in review.

#### THE PALATE, ETC.

The whole palate is, in essence, that of the Hairy-nosed Wombat, and is not so closely allied to that of the Tasmanian Wombat—namely, the prepalatine fossa is the same, although less deeply impressed, and the second pair of molars are not carried inwards upon the palate, but remain practically in the same alveolar curve as their fellows.

The total length of the bony palate is 305 mm., and that of the tooth line—175 mm. The widths between successive teeth, measured between the centres of the teeth named, are as follows:—

Between	Premolars (centres)	...	...	55 mm.
„	Molars I.	„	...	64 „
„	Molars II.	„	...	74 „
„	Molars III.	„	...	75 „
„	Molars IV.	„	...	75 „

The basi-occipital has coalesced with the basi-sphenoid, their sutures being obliterated, as are those of the palato-ptyergoids. The maxillo-palatine suture crosses the palate at the interval between the third and fourth molars—touches the alveolar ridge at about the same point, zig-zags along the base of the last molar, turning outwards and downwards to be lost in the overlap of the maxillo-ptyergoid plates. If a set of bristles are placed in the nine main foramina of the base of the skull, a similar set in the skulls of the two Wombats, that now exist in South Australia and Tasmania, it will be seen that with leanings now to one, and now to the other, the foramina of the Giant *Nototherium* are all depicted in the two crania named. The anterior condyloid is nearer to the Tasmanian skull; the fissura lacera is partly individual, owing to the enormous development in the *Nototheria* of the par-occipital, and the rest alternate in likeness from one to the other; but the general approximation to the Wombat is exceedingly close all through.

Owing to mutilations in the palate of *Nototherium tasmanicum*, it is not easy to conduct a comparison with the skull now under review, but it appears to have manifested as many differences as the two Wombats' skulls do in their departures from a common type.

The following table of measurements will give an accurate idea of the size of the skull:—

Total length between vertical rods	535 mm.
Greatest width ... ..	380 „
Height resting upon pre-massiter processes (without mandible) ...	260 „
Greatest width of forehead ... ..	175 „
„ „ „ nasals ... ..	175 „
From occiput—in a central line—to the tips of the nasals ... ..	380 „
Width of occiput ... ..	340 „

MANDIBLE.

Having stated that the mandible from the Boyd's Collection (5) is exactly similar to that of our male animal from Smithton, a general knowledge of these jaws will be widely available—since casts are always obtainable from the British Museum, and most Museums hold copies. These jaws are incomplete, anterior to the diastema, and the ascending coronoid processes are missing. Some of these imperfections are now made good by our photograph of the Tasmanian mandible, and these, together with the

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(5) Brit. Mus. Cat. Foss. Mamm. f. 32,050.

appended measurements, will supply sufficient data to separate these jaws from those of any other *Nototheria*. From the *Leptocerathine* group, they can be distinguished by the twisted coronoid processes, a character sufficiently well marked to serve all taxonomic needs.

Greatest length between two vertical rods ... ..	422 mm.
Height to condyle ... ..	280 ,,
Length of symphysis ... ..	165 ,,
Greatest depth of the mandible ...	127 ,,
Antero-posterior length of molar No. 4 ... ..	45 ,,
Width of ditto ... ..	35 ,,
Length of diastema (to base of tusk) ... ..	55 ,,

Any of the above measurements that can be compared with those furnished by the Boyd's Collection mandible, will demonstrate their specific and sex similarity of the two specimens.

#### TAXONOMIC.

As we have to deal in the fewest possible words with an extensive mass of notes that directly relate to our subject, we proceed at once to state that Professor Owen's original species, *Nototherium mitchelli*, of which we consider we have determined the sexes, stands apart from all other *Nototheria*. The species were horned, and platyrhine in cranial morphology, and were, moreover, sufficiently removed from the remainder of the stirp to found generic characters upon, if such were a desideratum. We rule out Owen's species, *Inerme*, for the present, but recognise his third species, *Victoria*, as being part of the second group that includes the following:—

<i>Nototherium victoriae</i> , Owen	Date, 1872.
<i>Euowenia grata</i> , De Vis.	Date, 1887.
<i>Euowenia robusta</i> , De Vis.	Date, 1891.
<i>Nototherium tasmanicum</i> , Scott.	Date, 1911.

The several relationships within this group still present difficulties that an accession of future material may banish at any time. Some of these difficulties are directly due to a want of exact knowledge respecting the characters that determine sex, in relationship to growth stages. It looks upon the surface as though *Euowenia grata* was a female animal, and the so-called species, *robusta*, was the male. De Vis admits that *robusta* was so close to Owen's *victoriae*, that he hesitated upon the

act of separation, but he makes *robusta* a flat tusked animal, which agrees better with a female than a male animal. Now *N. tasmanicum* agrees better with *Euowenia* than anything yet described, and we are convinced that De Vis' crushed skull, elevated to the type of the genus, was mutilated in the nasal regions, and the mutilation masked the real truth as to its normal structure. The skull of *N. tasmanicum* was recovered in thirty-six pieces, and, when first brought to light, was mutilated to the *Euowenia* outline! In other words, the whole nasal platform was carried away, and was not discovered until six weeks afterwards. If the figure of that skull (6) is examined side by side with De Vis' figure (7), it will be easy to see that a few lines with a pencil can convert the one into the other, and before the skull of *N. tasmanicum* was repaired, the likeness was most striking. De Vis' other great generic character was the slender zygomatic arch. This also is a mutilation (8). De Vis did not recognise it as such, because he was comparing the *zygoma* with the *mitchelli* type of animal, and the *zygoma* of that creature would not easily mutilate in quite the symmetric way that the *zygoma* of the second group can, and do—accordingly. De Vis mistook the mutilation for a generic character. In all this, of course, De Vis had never seen the un-mutilated *zygoma* of the second group; hence we can understand and appreciate his position, although a mistaken one! For in the second group, the sub-orbital portion of the zygomatic arch is so rounded and thinned away, that a fracture would convert it readily enough into the slender zygoma of De Vis' figure and descriptive text. We have not included in this second group of *Nototheria* the species, *Dunense*, on the grounds that, in our opinion, it really relates to *Phascolonus*. With the clearing up of the *Sceparnodon* and *Phascolonus* puzzle, at the hands of the late Sir E. Stirling, the claims of the type jaws of *Dunense* to any genus other than that of *Phascolonus*, became remote, and in the circumstances we remove it to the *inserta sedis* section, that includes *Inermis*, *Dunense*, and *Sthenomerus*. Of this latter we have only one word to say, and that is—As the real limb bones of the *Nototheria* were not correctly relegated to the genus *Nototherium* until 1910, and *Phascolonian* bones were previously usurping their places, we consider the bones relegated

(6) Monograph, *Nototherium tasmanicum*, Pl. I.

(7) Proc. Roy. Soc., Queensland, Vol. 4, 1887.

(8) The malar is stripped right out, leaving only the maxillary process in front, and the zygomatic process of the squamosal behind—apparently driven up on to the skull so as to expose its lower edge.

by De Vis to *Sthenomerus* most likely belong to *Nototherium*, and a re-examination of them in the light of later discoveries would, we fancy, establish some such fact. It appears to us that the interests of science will be better served by founding two well-marked groups, than by exhaustively contending the claims of the various species, and in this connection we present the following:—

### CLASSIFICATION OF NOTOTHERIA.

#### GROUP ONE.

*Megacerathine* Group.

#### GROUP TWO.

*Leptocerathine* Group.

### CONSPECTUS OF MEGACERATHINE NOTOTHERIA.

Animals of platyrrhine cranial morphology, with flat foreheads and parietal platforms. Nasals not quite covering the nasal aperture; if anything, more so in the female than in the male. Zygomatic arches asymmetrical, the difference being well marked! Sub-orbital bar heavy, and slightly grooved at the malar suture. Tooth-line showing fairly even wear throughout. Teeth with well-marked cingula. Cervicals with strongly developed zygopophyses, and a powerful axian spine. Coronoid process of the mandible twisted from the tooth-line, as in the latifrons Wombat's jaws<sup>(9)</sup>. Skull heavy, short nosed, and horned. A second very small horn may have rested on the frontal cavity. Nasal cartilage attached by bony studs, capable of motion, to resist shock when horning a foe, and also to give extra mobility to the lips. (Example: *Nototherium mitchelli*.)

### CONSPECTUS OF LEPTOCERATHINE NOTOTHERIA.

Animals of leptorrhine cranial morphology, with triangular foreheads and parietal crests. Nasals curved over nasal aperture. Zygomatic arches symmetrical, rounded, and deeply grooved. Tooth-line showing uneven wear, the excess always being anterior. Teeth without cingula, of a heavy type. Cervicals with a slender axian spine. Coronoid process not much, or not at all, twisted from the toothline<sup>(10)</sup>. Skull heavy (less heavy than the other

(9) 35 degrees from the line of symphysis.

(10) 15 degrees from line of symphysis, in *Phascolonus tasmaniensis*.



group), long nosed, and armed only with small nasal bosses, or a very weak horn. Nasal cartilages attached by bony studs, capable of motion, but tending to fuse at maturity, owing to longer nose and weaker horn. (Best known example: *Nototherium tasmanicum*.)

The remaining members of this group are—*Nototherium victoriae*, Owen; *Euowenia grata*, De Vis; *Euowenia robusta*, De Vis. It is apparent to us that the jaws Professor Owen thought might be those of a female come within this group, but their exact position is uncertain.

It is unfortunate that De Vis' name *Euowenia*, is later in time than *victoriae*, as it would have made a nice setting to have called this group by that name. The word *victoriae* is so suggestive of geographical bounds as to cause misconceptions to arise respecting it, and *tasmanicum* came too late in time to enter such a contest, even if it were suitable for such a group—which, of course, it is not! Accordingly, we leave the group to its *Leptocerathine* title, only using *Nototherium tasmanicum* as an example, because it is the most perfect skeleton yet recovered. We have a large mass of notes relating to the classification of such Museum specimens as have been fully described, but in our opinions—as already said—the creation of two well-marked groups covers all the immediate needs of taxonomy. In working over the lines ploughed out by those who have gone before us, we recognise nothing but honest attempts to arrive at the truth, and any mistakes that have crept in have been due to imperfect material rather than to any defect of judgment, or want of perspicuity, upon the part of those who rescued and described fragments of jaws and skulls from the pleistocene scrap heaps of Nature. A single illustration will make clear our meaning. De Vis always thought that the oval, tuberculated, premolar of the upper jaw would be opposed by a similar tooth in the mandible, and the narrow elongated tooth that really does oppose it be considered generically distinct! Such are the surprises that Nature springs upon us, that it was only with the finding of associated jaws in 1910 that any accurate data existed upon the subject. Our latest Smithsonian find—armed with a full set of unworn teeth—displays the wonderful manner in which the elongated, triangular premolar of the lower jaw exactly fits the inner two-thirds of the large, oval, upper premolar—the outer third of that tooth in unworn specimens forming only part of the gripping area. When the mandibular premolars are thus capped, and overhung by the upper premolars, the

anterior tooth-line is firmly locked against lateral motion. This is apparently correlated with the gripping of the tusks upon the lateral incisors, as though the anterior cheek teeth, tusks, and lateral incisors were closed down upon some object to be tightly held <sup>(11)</sup>. In bringing the true molars into action (for cross grinding), the curve of the total tooth-line is such as to free the premolars, and they can cross and recross each other without actual contact, and accordingly, the outer third does not in any sense limit the rolling motion of the jaws under this latter operation. The curve of the tooth-line is aided in this matter by the fact that the mandibular premolars are set lower than the molars. The two factors combined produce the result named.

Here then is the answer to the seeming anomaly of an elongated and narrow lower premolar, being mutually associated with an upper, oval, tuberculated one (one-third greater in width), and which, in occlusion, fits tightly, and duly locks lateral motion when so required.

In the *Leptocerathine* group, the animals all unduly wear the anterior tooth-line, and the premolars, after a time, cut their crowns under the normal action of food grinding; the result is, such premolars are always denuded of their cusping. The cusps in the lower premolars are steeply bevelled, and, therefore, the outlines of excessively worn teeth always appear larger than those with unworn crowns. This also clears up a point!

As the condyle of the *Nototherian* jaw is exactly similar to that of the Wombat, the amount of cross grinding action is also similar, but, as just shown, a champing and gripping action is also provided for, it being only necessary to move the contracting pressure of the jaws either forward or backward, to call either into play.

This association of such dissimilar teeth in a single animal possibly throws a sidelight on the old *Protemnodon* and *Procoptodon* puzzle, but we have no specimens to refer to.

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(11) As well as serving for fighting purposes the arrangement of the incisors would be of service to the animal when gathering branches, etc., for its food, the vegetable matter being treated much as a modern wombat does with the longer grasses, etc. We have observed wombats feeding amid such herbage, and their sharp incisors are first brought into play in order to sever the stem from its base, after which the stem is drawn into the mouth for treatment by the molars. Certain of the present day rhinoceroses feed on branches, etc., and most probably such formed a large percentage of the food of the *Nototheria*. The incisive tusks and the general arrangement of the teeth would admirably serve the double purpose of securing food and of being a fighting weapon of no mean order.

It might also be mentioned here that the teeth of certain species of rhinoceroses of the present day serve as an indication of species. In the black rhinoceros, which feeds upon branches, roots, etc., the teeth are worn into alternate ridges and hollows. In the so-called "white" rhinoceros, which feeds by grazing, the teeth are worn into a flat plane.

It will be remembered that in the type skull of *Zygomaturus*, the two premolars are of unequal size, and that De Vis and Lydekker debated this point with some heat <sup>(12)</sup>, the latter always contending that the *Zygomaturus* skull manifested both kinds of premolars, claimed by De Vis as generic characters, and that both could not have been associates of the skull. With what we know of *Nototherian* skull asymmetry, we are not too sure of this, and even supposing that no mutilation of the smaller one was responsible for its reduced size, we could yet believe a normal, and very well marked difference might exist in the two premolars of a single skull.

All of which tends to prove how unwise it is to dogmatise over small dental variations, the more so when a very slight fracture would remove the outer third of a premolar, and so convert an oval and multituberculate one into an elongated angular crown of no special complexity.

## THE OTHER SIDE OF THE TAXONOMIC QUESTION.

As we are making every honest endeavour to elucidate the truth, and not attempting to bolster up any special theory, we present the alternative to the double group system of classification here adopted—namely, that of a single species of *Nototherium*, with all variations, the results of age and sex.

We get at the outset the fact that the instinct of Professor Owen led him to determine two good species—*mitchelli* and *victoria*, and although Lydekker regarded the latter as a mere individual variation of the former, both Queensland and King Island have yielded similar specimens under conditions that certainly do not suggest any such assumption as that just cited. Nevertheless, if a single species is contended for, this evidence must be set aside, as also the following facts relating to this special connection:—

- A. That De Vis found enough variation in the *victoria* remains that came to his hand, to found a genus upon, some of which was by admission unsound, but the rest was supported by similar variations observed in Tasmanian *Nototheria*.

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(12) Ann. and Mag. Nat. Hist., 1889, p. 150.

- B. That the astragalus of *N. victoriae* (as obtained from King Island) presents enough variation from that of *N. mitchelli* to found a genus upon, and would, if treated as an isolated fragment, be certainly so classified by most palæontologists (*vide* Page 44 of Monograph of *Nototherium tasmanicum*).

Again. It will have to be shown that *Nototherium tasmanicum*, an animal as powerfully tusked as *N. mitchelli*, was a female, in the face of the fact that the original *Zygomaturus* skull presents all the characters that usually determine sex. That this latter is not to be confounded with *N. tasmanicum* is provided for in the circumstances of—

- A. A parietal crest as against a sagittal platform.
- B. A small forehead, as against a large flat one.
- C. A leptorhine, as against a platyrhine cranial habit.
- D. Untwisted coronoid processes, as against twisted ones.
- E. A tall, slender atlantean spine, as against a wide, heavy; and more or less dwarfed one.
- F. It will also have to be explained why the very characters that led us—although quite unbiased as to results—to found *Megacerathine* and *Leptocerathine* groups, are (with the exceptions of those directly relating to the nasal horn) exactly those that segregate the hairy-nosed Wombats from the mainland and Tasmanian forms.
- G. That a number of *Nototheria* wore the anterior teeth to the exclusion of the posterior ones is an observed fact—and always appears in the very creatures that apparently fought by gripping with their tusks and lateral incisors, and were by cranial morphology unsuited for the possession of large nasal horns. That these animals were not females, is suggested by their large size and powerful tusks, and by the fact that the type of animal called *victoriae* had the very kind of tusks one would naturally associate with their mates, and which are not without parallel in the larger animal, we believe to be the female of *Nototherium mitchelli*, thus suggesting, again, their sex determining value.

We do not imagine for one moment that we have cleared up all the mysteries that surround the *Nototheria*, but we hope we have so recapitulated the facts that the discoveries of the future may work more or less smoothly into line, and perfect our knowledge of the wonderful giants of pleistocene days.

When variations of the mandibular symphyses, bounding lines of horizontal rami—namely, contour lines, angles of coronoid processes, positions of dental foramina, etc., have all been relegated to the section headed—"Characters displayed during growth from immaturity to "maturity"—there still remains the material used by us for outlining our two groups of *Megacerathine* and *Leptocerathine* animals, and so for the present we leave the subject with that taxonomic setting.

#### THE HORN IN THE *LEPTOCERATHINE* GROUP.

Professor Watson's idea of the fighting bosses in *Nototherium tasmanicum* was that of bony eminences covered with skin. If we take an analogy from the Ungulates we get—

1. Rudimentary, skin covered bosses in Horses, as an abnormal condition.
2. Skin and hair covered bosses in Giraffes.

Among the gigantic ungulates of the American tertiary series, many instances of bony bosses obtain.

#### THE EVOLUTIONARY TREND.

To appreciate even the little we know of the evolutionary trend among the marsupials that culminated in the *Nototherian* stirp, it will be necessary to tabulate the various characters involved therein, with special reference to a geological succession.

#### PRE-EOCENE.

From Pre-Eocene times, the *Nototheria* retain—

- A. Marsupial anatomy generally.
- B. Well developed clavicles, relating to pouch manipulation by the hand and forearm.
- C. Five fingers and five toes.
- D. An entepicondyloid foramen to the humerus.



## EOCENE.

From Eocene times; the *Nototheria* retain—

- B. Bilophodont molars (still manifested among the modern Tapirs, to some extent) as found in many Eocene ungulates.
- B. Flattened femora and humeri of generalised Eocene mammals.

The absence from the head of the femur in the *Nototheria* of a ligamentum teres brings the animals into line with the Eocene *Dinoceras*, as well as the following living and extinct forms:—Elephant, Sea Otter, Sea Elephant, Orang, both forms of *Monotremata*, and the gigantic pleistocene Ground Sloths of South America.

## MIOCENE.

From Miocene times, the *Nototheria* retain but little that is essentially characteristic, unless the nasals of such forms as have advanced the least upon the fighting trend really do manifest bony cores, which is at present uncertain. The facts point to a higher stage in *N. tasmanicum*, making an approach to the pliocene dermal horn stage.

## PLIOCENE.

From Pliocene times the *Nototheria* retain—

- A. The central nasal horn, or horns.
- B. *N. tasmanicum*, and its allies, show about the same amount of development in this connection that pliocene ungulates did.
- C. *Nototherium mitchelli* appears to have advanced to early pleistocene in this matter, but still retains the pliocene characters of short and wide nasals, as in *Pachygnathus*.
- D. A character here also reaches towards the *Tapir* stirp, as much as towards the *Rhinocerotidæ*, namely, in *N. mitchelli*, the nasal septum extends beyond the nasal bones, as in *Elasmognathus*, while in the other *Nototherian* group (*N. tasmanicum* and its allies), the nasals extend to the nasal septum, as in *T. indicus*, *T. americanus*, and *T. roulini*. Always, of course, with special, marsupial variations.

## PLEISTOCENE AND RECENT UNGULATE CHARACTERS SHOWN BY *NOTOTHERIA*.

*Rhinocerotidae*. The *Nototheria* approach these perissodactyle animals in the structure of the palate, the short neck, the horn, or horns, being developed in the mid-cranial line. The horns are also similarly nourished by anterior central and centro-lateral vascular supplies, but manifested a stirp character, in a central basal blood supply, not found in Rhinoceroses. They also approach these ungulates in the morphology of the occiput.

*Tapiridae*. The *Nototheria* approach these Ungulates in the matter of bilophodont teeth. In having one premolar deciduous, but show a stirp trend in its being the fourth, instead of the first. They also show the Tapir character of not developing a third trochanter to the femur.

### AS AN INDIVIDUAL STIRP.

The *Nototheria* show in the skeleton, marsupial bones, clavicles, an entepicondyloid foramen. Pentadactyl feet and hands. Longer lumbar regions than either Tapirs or Rhinoceroses possess. Premolars reduced to a single pair in either jaw. Incisors retained.

### INTER-STIRP CHARACTERS.

Within the stirp the *Nototheria* display a blending of Kangaroo, Wombat, and Native Bear characters, in addition to their own osteology.

### RECAPITULATION.

In the *Nototheria* we thus find a group of animals that in Tasmania became extinct late in pleistocene times, that were generalised, and yet, in part, specialised. They retained the racial characters that can be relegated to five geological periods—that is, from the pre-Eocene to the latest pleistocene. They show similar developments to those of the perissodactyle ungulates, and without leaving a single modern representative to carry on their race, in totality, they have left many characters scattered through their marsupial allies—the Kangaroos, Wombats, and Native Bears, who still grace our woodlands to-day.

EXPLANATION OF PLATES XIII.-XXI.

*Nototherium mitchelli*.

PLATE XIII.

The side aspect of the skull giving structural details of the ear, zygomatic arch, tusks, and nasal septum.

PLATE XIV.

Showing the face, toothline, nasal studs, pre-alveolar extension of the tusks and the asymmetrical processes.

PLATE XV.

Skull resting upon tusks, and pre-massiter processes. Showing nasal platform, nasal studs *in situ*, also concave frontal platform, upon which a second small horn may have rested.

PLATE XVI.

Skull, showing the toothline, palate, and basic view generally.

PLATE XVII.

Showing nutrient foramina coming up to nasal platform, parietal platform and occiput, also convex contour of the parietals as they contribute walls to the temporal fossæ.

PLATE XVIII.

Mandible orientated to show toothline and mutilation to tusk due to an accident in life.

PLATE XIX.

Mandible in side view, showing cingula of teeth, dental foramen, etc.

PLATE XX.

Mandible arranged to show both condyles, coronoids mutilated (*post mortem*). Contour of condyle similar to that of the platyrhine wombat.

PLATE XXI.

Contour lines of the nasal platforms of *Nototherium mitchelli* male and female.

No. 1. Male.—Vertical axis = 110 mm; transverse axis = 108 mm.

No. 2. Female.—Vertical axis = 115 mm; transverse axis = 80 mm.

A & B indicate nutrient foramina in anterior regions. C is a third foramen for nourishing the base of the horn.



NOTOTHERIUM MITCHELLI.



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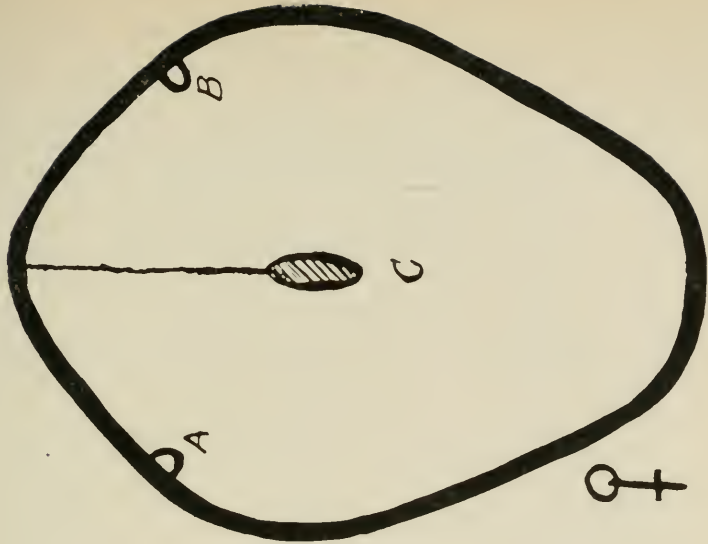


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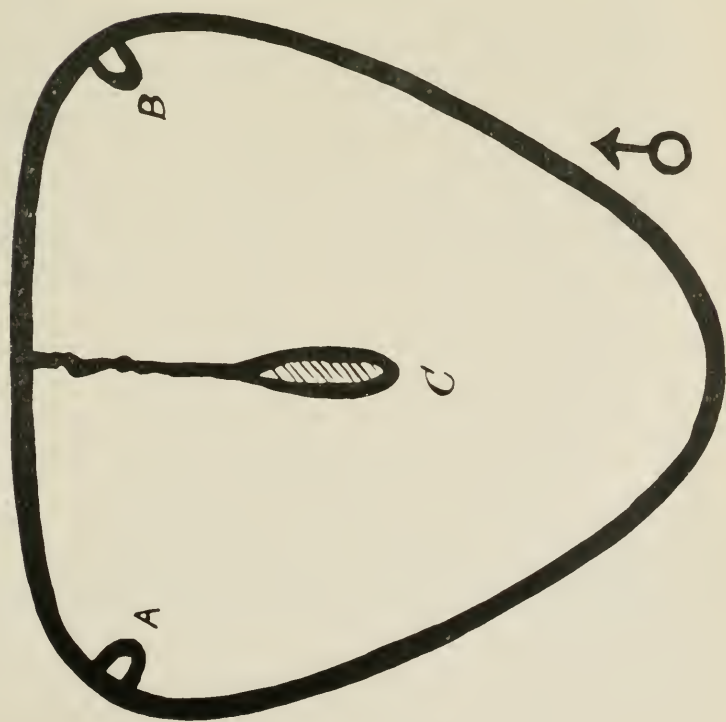




NOTOTHERIUM MITCHELLI.



NO 2



NO 7