ON SOME

OUTLINE-DRAWINGS AND PHOTOGRAPHS

OF

THE SKULL

OF THE

ZYGOMATURUS TRILOBUS,

AND ON A

COLLECTION OF AUSTRALIAN FOSSILS

IN THE

MUSEUM OF THE NATURAL HISTORY SOCIETY AT WORCESTER.

BY

PROFESSOR OWEN, F.R.S., F.G.S., ETC.

[*From the* QUARTERLY JOURNAL OF THE GEOLOGICAL SOCIETY *for February* 1859.]

On some Outline-drawings *and* Photographs *of the* Skull *of the* Zygomaturus trilobus, *Macleay* (Nototherium, *Owen?*).

By Professor Owen, F.R.S., F.G.S., &c.

[Plates* VII. and VIII.]

Sir R. I. Murchison placed in my hands a few days ago seven photographs, three of which are stereoscopic, of perhaps the most extraordinary mammalian fossil yet discovered in Australia.

These photographs, with a brief printed notice of their subject by Wm. Sharpe Macleay, Esq., F.R.S., and some MS. notes by J. D. Macdonald, M.D., R.N., had been transmitted to Sir Roderick by his Excellency the Governor Sir W. Denison, from Sydney, New South Wales; and it is by the desire of Sir Roderick Murchison that I now bring the subject under the notice of the Geological Society of London, to whom Sir Roderick desires to present the Photographs, on the part of His Excellency, Sir Wm. Denison.

I had, some weeks previously, received from my friend and correspondent, George Bennett, Esq., F.L.S., of Sydney, New South Wales, the accompanying outlines of the same fossil skull, made by him on the reception of the specimen by the authorities of the Australian Museum at Sydney, and I had penned notes of my comparisons of these sketches before receiving the photographs and descriptions of the fossil skull from Sir Roderick I. Murchison.

Mr. Macleay's description appears in a Report on "Donations to the Australian Museum during August 1857," published in a Sydney newspaper of about the same date. It is as follows:—

"Fossil Skull of a new marsupial animal, which bears a nearer approach to

* In Plate VII. the skull under description is figured, on a reduced scale, from casts received at the British Museum since the reading of this paper. See further on p. 176.

Diprotodon than to any other known genus. The size was apparently that of a large ox; and the skull agrees with that of the *Megatherium*, and others of the American tardigrade *Edentata* (living and extinct), in having a long apophysis descending from the zygomatic arch, as well as in other particulars. However, this process of the zygoma exists in the *Diprotodon*, and may be detected even in the Kangaroo. Another characteristic of this new quadruped, which may be called *Zygomaturus*, is the great distance of the zygomatic arch from the temporal bone. The breadth of the skull at the widest part—namely, about the centre of the zygoma—is fifteen inches; the extreme length of the skull is about eighteen inches. In the *Diprotodon* the skull is, on the other hand, about three feet long by one foot eight inches broad; so that, while the *Diprotodon* must have had a facies somewhat like that of a Kangaroo, the facies of the *Zygomaturus* must have been about as broad and short in proportion as that of a Wombat. The lower jaw of the specimen in the Museum is wanting; but the formula of dentition in the upper jaw is as follows:—6 incisors, 0 canines, 10 molars. The two front incisors are very long and strong, as in the Kangaroo and *Diprotodon*. The above dental formula agrees with that of *Diprotodon*, except that the latter animal had only eight molars in the upper jaw. The *Zygomaturus* had many points of structure approaching those of the Rhinoceros and Tapir family. For instance, the molars resembled in form those of the Tapirs, while the nasal septum may remind us of the *Rhinoceros tichorhinus*, a fossil species that formerly inhabited England and other parts of Europe. The strong and very prominent trefoil-shaped arch formed by the extremity of the nasal bones, shows that, if the *Zygomaturus* did not possess a snout like that of a Tapir, it must, at least, like a Rhinoceros, have had a horn (perhaps a double one) on the nose. Without doubt this horn was used for grubbing up the roots of aquatic plants, since, like the pachyderms, to which it bears so close an affinity, in all probability the *Zygomaturus* passed its life in marshy places. The extraordinary width of the temporal fossæ denotes that the animal possessed enormous powers of biting and mastication.

"This skull belonged to an adult animal, as the molars are considerably ground down.

"Also, the upper jaw of a young *Zygomaturus*, as appears by the tips of the molars being perfect.

"Another portion of an upper jaw, and a humerus, probably of a *Zygomaturus*; base of left ramus of the lower jaw of *Diprotodon*; and front incisors of ditto.

"All the above fossil remains are from King's Creek, Darling Downs, being the same locality whence the entire skull of the *Diprotodon* was obtained some years ago. Frederick Neville Isaacs, Esq., Gowrie, Darling Downs."

The notes of Dr. J. D. Macdonald, R.N. (Assist.-Surg. H.M.S. Herald), are without date, but appear to have been made from actual inspection of the fossil itself, probably on the occasion of the Doctor's visit to Sydney, in 1857; they are as follows:—

"*Zygomaturus trilobus* (Macleay).

"The photographic figures of the skull of this remarkable animal, executed by Mr. Wilson, require a few words of explanation, in order that some at least of the many queries which will naturally arise in the mind of an anatomist inspecting them, without the means of consulting the original, may be as it were anticipated and answered.

"First, then, the granular appearance of the surface is due to the adhesion of particles of grit and alluvial matter, which had not been removed in consequence of the extreme brittleness of the bone beneath.

"The tables of the skull are of great thickness, and thrown apart by large cellular cavities, lined with a compact osseous tissue. The frontal sinuses especially are of enormous size, divided by a thin vertical septum, and giving rise to the angular fulness of the antero-lateral part of the forehead. A small piece of the outer table having been broken away on the right side of the occiput, an

opening remains, communicating with the cellular structure within, which bears the strongest analogy to that occurring in many pachyderms. Moreover, the several cranial bones exhibit a corresponding tendency to unite by anchylosis.

"The brain-cavity is exceedingly small, as might be expected from the above details; and its long axis very nearly corresponds with that of the cranium, which may be said to meet the general plane of the palate at an angle of 60°.

"The whole head may be divided longitudinally into three portions of nearly equal breadth; the brain-case, with its cellular parietes, &c., occupying the central, and the zygomatic arches the lateral, parts,—the forehead, nose, and palate, including the molar teeth, being equal in transverse measurement. The palatal arch is single and smoothly rounded off, so that the posterior nasal spine is absent. The lateral, thickened, and rounded nasal lobes are processes of the premaxillary bone, which unite with the maxillaries in a curved vertical suture with its concavity directed forwards.

"The tail-like process projecting downwards and backwards from the anterior and inferior part of the zygomatic arch has its homologue in the skull of many animals, even in that of man himself. It is, therefore, jointly composed of the malar process of the superior maxillary bone and the maxillary process of the malar bone, united by a vertical suture. This projection must have given attachment to the zygomatic muscles, and perhaps to a few of the anterior fibres of the masseter, although extending below the level of the upper molars. That of the left side has been slightly injured.

"The zygomatic process of the temporal rests upon that of the malar bone, with an oblique line of union running through the upper horizontal portion of the arch.

"The anterior convex border of the zygoma being nearly on a plane with the external angular process of the os frontis, and the remarkable manner in which the cranium is elevated on the facial bones, indicate very clearly that the eyes of this animal were directed forwards, admitting of convergent vision. The low position of the *optic foramen* also shows that the eyes must have been situated close to the orbital border (if it may be so called) of the superior maxilla."

Notes on the Outline-drawings.—One of the peculiar features of the skull of the phytophagous Marsupials, whether of the browsing Kangaroos and Potoroos, or of the leaf-and fruit-eating Koalas, Petaurists and Phalangers, or of the burrowing and root-gnawing Wombats, is the great strength, size, and span of the zygomatic arches, as compared with the answerable vegetable-eaters in the Placental series of Mammalia*.

This character is least marked in the true Kangaroos; but it is sufficiently distinctive of these as compared with the browsing or grazing Pecora of similar size: and there is a modification of the zygomatic arch in *Macropus* for extending the base of origin of the masseter masticatory muscle, which is present in no gyrencephalous† Herbivore, although it exists in the lissencephalous† Sloths and their great extinct herbivorous congeners the Megatherioids—I allude to the descending process from the fore part of the zygomatic arch (Plate VII. fig. 2, *z*).

In all those herbivorous mammals in which the grinding teeth present two transverse ridges, the zygomatic arches are well developed, the bony bar or plate being of great vertical extent: the Tapir, the Manatee (Plate VIII. fig. 1, *z*, fig. 3, *z*), and the Megathere

* See 'On the Osteology of the Marsupialia,' Zool. Trans. ii. p. 387, pls. 69 and 71.

† For the meaning of these terms see my 'Classification of the Mammalia,' in the 'Proceedings of the Linnæan Society,' Feb. 17 and April 21st, 1857.

show this relation, as well as the Kangaroo, Wombat, and Koala (fig. 2, *z*); and the temporal fossa is of considerable capacity, as it also is in the great Dinothere, which has the same type of molar teeth. The working of opposed double-ridged molars evidently requires a greater amount of muscular action than that of the more complex but flatter molars of the Ruminants, Horse, Rhinoceros, and Elephant.

The maximum development of the zygomatic arches, in connection with grinding teeth of the type of those of the Kangaroo and Tapir, is manifested by a most extraordinary Marsupial Herbivore, of the size of an ox, the cranium of which has recently been discovered in Pleistocene deposits at King's Creek, Darling Downs, Australia, and is now in the Museum at Sydney, N. S. Wales.

I am indebted to my friend Mr. George Bennett, F.L.S., for four carefully-made, and apparently most accurate, outline-drawings of this unique fossil, in which so much of the anatomical characters are given as have enabled me to make the requisite comparisons for a conclusion as to the nature and affinities of the, most probably, extinct Australian quadruped. The dentition of the upper jaw consists of three incisors and five molars on each side, of which the first appears to be a premolar and the rest true molars: *i. e.*, *i.* $\frac{3-3}{}$, *c.* $\frac{0-0}{}$, *p.* $\frac{1-1}{}$, *m.* $\frac{4-4}{}$; agreeing, in this formula, with *Macropus* and *Diprotodon*.

The reduced size of the drawings does not permit one to infer more than a close general resemblance of the transversely-ridged molars of the fossil with those of *Diprotodon* and *Macropus*.

The modifications of this dentition resemble those of the *Diprotodon** in the retention of the premolar after the last true molar has come into place, and in the superior size of the first as compared with the second and third incisors. From so much of the sockets of the first incisiors as is indicated in a front view of the cranium, it may be inferred that they were scalpriform teeth, implanted by a long, simple, slightly-curved base, of equal diameter with the crown. Each lateral series of grinders is slightly curved with the convexity outward; the two series converge a little forward.

All the grinding teeth are worn; the anterior most, and the rest by degrees less, to the hindmost, which is least abraded: this indicates the course of their succession, and throws clear light on the ordinal affinities of the fossil.

In the Tapir, as in other placental terrestrial *Herbivora*, the number of true molars being $\frac{3-3}{3-3}$, and the first of these, $m\,1$ (Plate VIII. fig. 4) coming into place and use before the last premolar $p\,4$ (*ib*), the first molar presents a more worn grinding-surface than the tooth which precedes it, $p\,4$: in the Kangaroo and other Marsupial *Herbivora*, the number of true molars is $\frac{4-4}{4-4}$; and, as they succeed each other from before backwards, the first of the four is always more worn down than the second, thus presenting conditions of the grinding-surface the reverse of those which would be presented by the

* See "Report on the Extinct Mammals of Australia," in 'Report of the British Association,' 1844.

Tapir, Stag, and placental *Herbivora*. If it were objected that the first and second of the five grinders in *Zygomaturus* or *Nototherium* may be deciduous teeth, destined to be succeeded by vertical successors or premolars, it may be replied, that no instance of the retention of deciduous molars with a last molar in place, and so worn as is the fifth grinder of *Zygomaturus*, has been observed.

A view of the upper molar series of a Tapir, soon after the last molar has come into place, is given in Plate VIII. fig. 4, to illustrate this difference from the state of the molar series in the Australian fossil (Plate VIII. fig. 5), in which the tooth, marked d_4, the fourth from the back end of the series, is much more worn than m_1, the third from the same end. This state of the dentition determines the marsupiality of this huge and most strange extinct quadruped as decisively as would the marsupial bones, had the entire pelvis been found.

All the cranial characters elucidating marsupial affinity concur with the dental ones in establishing it.

The brain was very small; its proper case makes no swelling from the inner wall of the temporal fossa (Plate VII. fig. 3, *t*) as it does in the Ox, Horse, Tapir, or other placental Herbivores of like size with the fossil. Equally indicative of the low condition of cerebral development is the inclination of the plane of the occiput from the condyles upward and forward, as shown in fig. 2, Plate VII.; and in fig. 3, taken looking directly upon the upper surface of the skull, in which the whole sloping occiput comes into view, divided from the upper surface by a super-occipital ridge which describes an open angle with the apex forwards. The constricted part of the cranium in advance of this ridge, and opposite the middle of the temporal fossæ*, marks the anterior boundary of the cranial cavity: the part *f* in advance, which gradually expands, answers to that part in the Kangaroo and Wombat which is occupied by the extensive cellular diploë, in communication with the nasal cavity†; such expansion of the pneumatic frontal bone is also found in the *Phascolomys latifrons*. The zygomatic arches, from their depth, thickness, outward span, and descending process (*ib.* fig. 2, *z*) present one of the most marked and peculiar features of the fossil skull from Darling Downs; the extent of the fossæ which they circumscribe, and their proportions to the rest of the skull, recall the features of that of the Elephantine Seal (*Cystophora proboscidia*); but the form and direction of the descending process, *z*, show this arch to be essentially an exaggeration of that of the Koala (Plate VIII. fig. 2) and Kangaroo. The descending process is, however, relatively larger and longer: in this respect it resembles the same part in the skull of the *Diprotodon*.

The power of the muscles of the mandible both for biting and chewing must have been enormous, and indicates some peculiar quality of resistance in the alimentary substances to be ground down. The grip of the strong and long anterior incisors, brought by the

* See 'Osteology of the Marsupialia,' loc. cit., pp. 380, 386.

† Ib. Part II. Trans. Zool. Soc., vol. iii. part iv. p. 303, plate 37. figs. 4 and 5.

shortness of the jaws within the power of the temporal muscles in a degree proportionately to the proximity of the inserted moving force, must have been like that of a vice.

The next peculiar feature of the present fossil is the small proportion of the facial to the cranial division of the skull. In Man and Apes the cranial division is coextensive with that part which forms the cavity for the brain; in lower quadrupeds it is bounded anteriorly by the orbit and fore part of the zygomatic arches, and usually includes the nasal and frontal sinuses, occupying a greater or less extent of the cranium anterior to the cerebral cavity. Defining the facial part of the skull of the present fossil, as the part in advance of the orbit (Plate VII. fig. 2), it forms, as it were, a short pedunculate appendage to the rest of the skull, increasing in both vertical and lateral extent as it approaches its anterior termination, or the muzzle. The lateral enlargement is due to an unusual rugous protuberant swelling of the sides of the nasal bones, or of the parts of the premaxillary articulating therewith: in the side view (fig. 2) may be discerned a suture, which indicates the swelling to belong to the premaxillary; but the upper view (fig. 3) does not show such suture. Only an inspection of the fossil itself can determine this point. The analogy of the Wombat and Kangaroo favours the conclusion that the premaxillaries united with the nasals.

In the Koala (*Phascolarctus fuscus*) and *Phascolomys latifrons* the fore part of the muzzle is expanded laterally by an outward swelling of the front border of the premaxillaries, just where they join the nasals (Pl. VII. fig. 5.); and both the Wombat and Koala resemble the fossil in question in the small proportion of the facial part of the the skull, as above defined. But in the fossil from Darling Downs, the lateral rough protuberances are continued along the anterior margins of the nasal bones, forming a thick and strong double arch, one over each nostril (Plate VII. fig. 4); the septum narium appears to have been continued forwards to near the above thickened terminations of the nasal bones. The upper surface of these bones seems not to have been roughened as in the Rhinoceros.

The length of the skull, as noted by Mr. George Bennett, on the sketches which have afforded subjects for the preceding remarks, is 1 foot 6 inches; its breadth 1 foot 3 inches.

By the dentition of the upper jaw, this fossil agrees in that essential character with the genus *Diprotodon*; but the dentition of the lower jaw might exhibit small incisors, superadded to the single large pair which is characteristic of *Diprotodon*, as of all known phytophagous marsupials. Supposing, as is most probable, that the lower jaw of the fossil in question had but two incisors, the next question would be, whether the peculiarity in the form and proportion of the skull, and especially in the position and aspect of the orbits, would justify a generic separation from *Diprotodon*, the dental formula being the same.

Another question also suggests itself,—whether, namely, the present skull may not belong to the same genus as that which I founded, under the name *Nototherium*, upon a mutilated lower jaw,

with double cross-ridged molars, similar in number to those in *Diprotodon*, and presenting the same inferiority of size as the upper molars of the present fossil from Darling Downs show. Mr. George Bennett has inscribed the name "Zygomaturus" beneath the sketches he has transmitted, and informs me by letter, that such is the name which Mr. Macleay has provisionally given to the fossil in the Catalogue of the Sydney Museum.

The bony palate appears to have been entire, or without any unusually large palatal vacuity, in this respect resembling the same part in *Macropus major* and *Diprotodon*.

Whether this fossil prove to be a second species of *Diprotodon*, or a distinct genus; and in the latter case, whether distinct from *Nototherium*, or identical with it,—it forms the most extraordinary addition to the evidences of those extinct phytophagous quadrupeds of Australia which exhibited the marsupial type on a scale rivalling the Rhinoceroses and large Buffalos of the warmer parts of the Asiatic and African continents. Let us hope that good plaster casts of the unique specimen may be made and transmitted to Europe, to enable a further insight into its nature and affinities.

Notes on the Photographs.—Since the foregoing notes were penned I have had the opportunity, through the kindness of Sir R. I. Murchison, to inspect the photographs and photographic stereoscopes of the skull to which the name *Zygomaturus trilobus* has been given by Mr. Macleay.

The photograph, No. 4, shows most satisfactorily the close similarity of the two-ridged crowns of the upper teeth to those of the *Diprotodon australis*, figured in pl. 2 of my "Report on the Extinct Mammals of Australia"*, and removes whatever doubt might have been left after inspecting the pen-and-ink sketches by Mr. Geo. Bennett, as to the order of succession of the last four grinders, as indicated by the degrees of attrition of their crowns.

The same important evidence of the marsupiality of the species is yielded by the teeth in the two portions of upper jaw figured in the stereoscopic views beneath the principal fossils. There is a low transverse basal ridge before and behind the two chief ridges; these are slightly bent, with the concavity looking backwards: they have not the connecting processes extending from the fore part, as in *Macropus*, and herein lies the generic distinction from the Kangaroos; but the close conformity between *Macropodidæ*, *Zygomaturus*, and *Diprotodon* in all the minor modifications of the crowns of the grinding teeth, as well as in their number, relative size, and order of succession, bespeaks in an equal degree their family relationship.

The extent of each molar series in *Zygomaturus* is about 7 inches; in *Diprotodon* it exceeds 8 inches: the attachment of the front pier of the zygomatic arch in *Zygomaturus* is opposite to and almost coextensive with the three middle grinders (Plate IX.†

* 'Report of the British Association,' 1844.

† See the next Memoir.

fig. 5); in *Diprotodon* it is nearly opposite the interspace between the penultimate and last grinders, being of much less extent (*ib.* fig. 6).

A close inspection, with the lens, of the photograph of the upper surface of the expanded end of the muzzle, confirms me in the conclusion that it does not present that character which indicates the attachment of the horn in the Rhinoceros: the irregularity of surface is not so much upon the upper part as upon the sides of the nasal aperture, which sides are at their upper part peculiarly tumid: but these irregular bossy terminations of the bony muzzle are formed, as we are assured by Dr. Macdonald, by the premaxillaries, not by the nasal bones; and this is an additional ground for rejecting the idea that the present large extinct marsupial had a nasal horn like the rhinoceros.

The cavity of the nose "is divided by a complete bony septum to within one-fourth of the anterior aperture"* in the Kangaroo and common Wombat: since that remark was printed I have described the skull of a rarer species of Wombat, showing some features of resemblance to the *Zygomaturus*, not given by the previously-known kinds, and in which the bony nasal septum advances very close to the anterior outlet of the cavity. By this analogy, therefore, rather than by that of the extinct Tichorhine Rhinoceros cited by Mr. Macleay, I should be inclined to illustrate the significancy of the naso-septal feature in the cranial structure of the large Australian fossil.

I suspect that the swollen, tuberose, antero-lateral borders of the bony nostril (Pl. VII. fig. 4), so well shown in the photograph, have relation to some most unusual developments of the naked integument of the muzzle of the *Zygomaturus* or *Nototherium*, superadding an extraordinary feature to its low-set forward-looking eyes, and very broad low cranium. Future evidences of the forms and proportions of the limbs of this animal will be received with much interest.

Wholly concurring in Mr. Macleay's conclusions as to the marsupial nature of the fossil in question, I have to state that the British Museum has now received ample evidence that the generic distinction which Mr. M. believes to exist between that fossil and *Diprotodon* is not present. In the cranium of the *Diprotodon* in the Sydney Museum, of which photographs have been transmitted to me by Mr. George Bennett, the number of molar teeth in the upper jaw is reduced to eight, four on each side: but it is by the loss of the first small molar: and from the appearance of that molar in *Zygomaturus* I conjecture that it would, also, be shed in an older individual. But there are specimens in both the British Museum and the Hunterian Museum which demonstrate that the *Diprotodon* has five molar teeth developed on each side of both upper and lower jaws, as stated in my "Report on the Extinct Mammals of Australia"†.

* "Osteology of the Marsupialia," *loc. cit.* p. 391.

† *Op. cit.* 'Report of the British Association,' 1844.

DESCRIPTION OF PLATES VII. AND VIII.

PLATE VII.

Fig. 1. Under view of the Cranium of *Nototherium Mitchelli*, Owen (*Zygomaturus trilobus*, Macleay): one-sixth natural size.
Fig. 2. Side view of the same: one-sixth natural size.
Fig. 3. Upper view of the same: one-sixth natural size.
Fig. 4. Terminal view of the nasal region of the cranium: one-sixth natural size.
Fig. 5. Similar view of the cranium of the Koala (*Phascolarctus*); one-half natural size.

[These figures, excepting fig. 5, are taken from the casts of the skull presented to the Trustees of the British Museum, and received since the reading of the foregoing paper. The original specimen is in the Museum of Sydney, N. S. Wales.]

PLATE VIII.

[The figures are reduced from specimens in the British Museum.]
Fig. 1. Cranium of *Manatus Americanus*.
Fig. 2. Skull of *Phascolarctus fuscus*.
Fig. 3. Cranium of *Tapirus Americanus*.
Fig. 4. Series of upper molar teeth of *Tapirus*, showing the greater attrition of the antepenultimate molar, *m* 1, in comparison with the tooth in advance, *p* 4.
Fig. 5. Series of upper molar teeth of *Nototherium*, showing the less attrition of the antepenultimate tooth in comparison with the tooth in advance.

On a COLLECTION *of* AUSTRALIAN FOSSILS *in the* MUSEUM *of the* NATURAL HISTORY SOCIETY *at* WORCESTER; *with* DESCRIPTIONS *of the* LOWER JAW *and* TEETH *of the* NOTOTHERIUM INERME *and* NOTOTHERIUM MITCHELLI, Owen; *demonstrating the identity of the latter species with the* ZYGOMATURUS *of* Macleay.

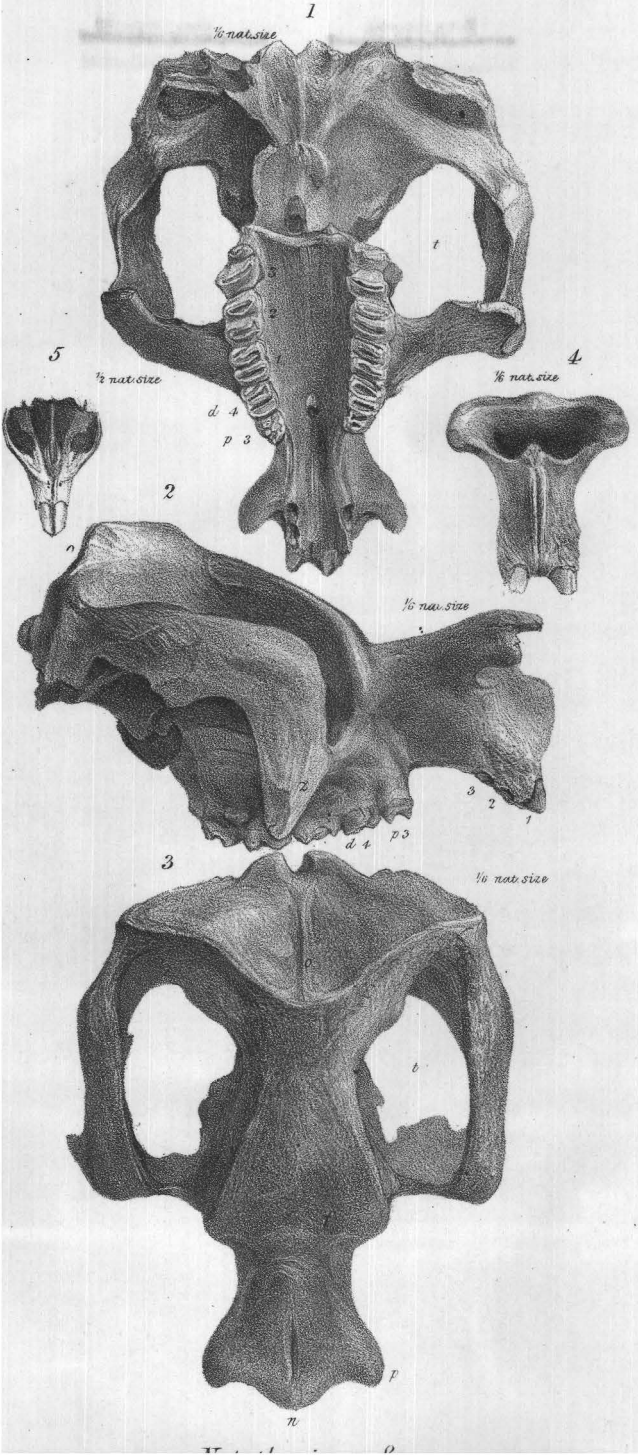
By Professor OWEN, F.R.S., F.G.S., &c.

[Plate IX.]

SINCE the communication of the remarks on the photographs of the fossil cranium referred by Mr. W. S. Macleay to a new genus of *Marsupialia*, which he has called *Zygomaturus*, I have received, for examination, through the liberality of the Council of the Natural History Society of Worcester, a series of specimens of mammalian fossils from the Condamine River and Darling Downs, Australia; there have also arrived at the British Museum casts of the cranium, and of the upper jaw and teeth of the *Zygomaturus*, liberally presented by the Trustees of the Museum at Sydney, N. S. Wales, by which I am able to demonstrate that this cranium belongs, as I suspected it might, to the genus *Nototherium*, and to that species which, in my "Report on the Extinct Mammals of Australia," I dedicated to the then Surveyor-General of Australia, Col. Sir Thomas L. Mitchell*.

The Worcester collection of fossils, contributed chiefly by Mr.

* *Nototherium Mitchelli*: see p. 13 of Owen, 'On the Extinct Mammals of Australia,' 8vo. 1845, p.p. 21, Plate i—vi, 4to.; also, 'Catalogue of Fossil Mammalia, Mus. Coll. of Surgeons,' p. 314, Plates iii. and iv. 4to. 1845.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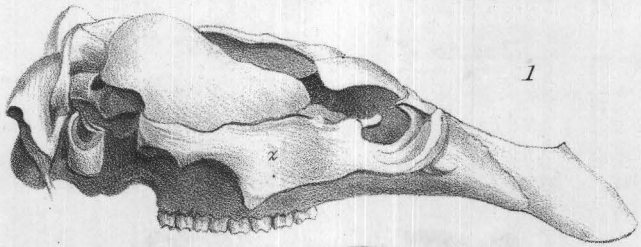

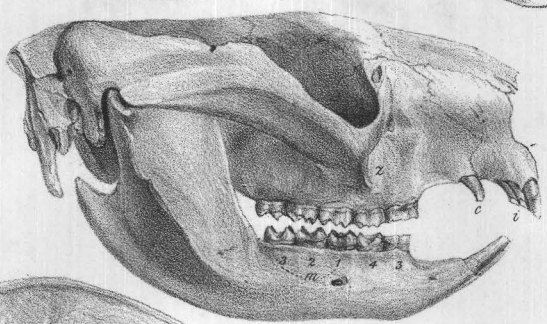

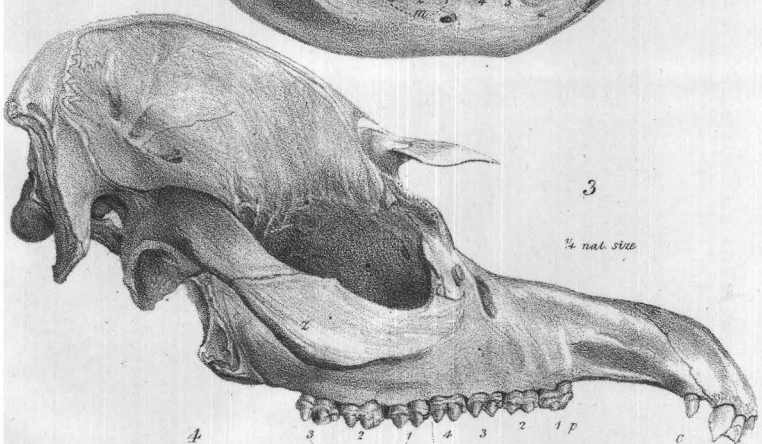

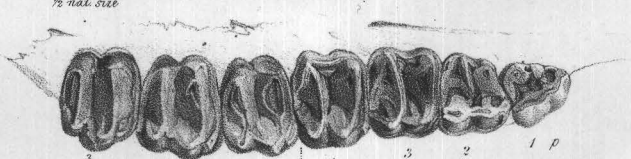

Manatus, Phascolarctus, Tapirus, & Nototherium.

Hughes, from freshwater (pleistocene ?) deposits of Darling Downs, contains the right ramus of the mandible of the *Nototherium inerme* (Pl. IX. fig. 3*), very closely corresponding with that figured in pl. 3 of my "Report" and "Catalogue." It fortunately includes sufficient of the symphysis to show the bottom of a socket of a small procumbent incisor. One of the differences between the cranium of the great *Diprotodon* and that of the smaller animal with double-ridged molars subsequently acquired is the relatively smaller size of the incisors in the so-called *Zygomaturus*. From the analogy of the *Diprotodon* and of its existing representatives, *Macropus* and *Phascolarctos*, the six upper incisors of *Zygomaturus* would be opposed by a single pair at the fore part of the lower jaw.

But this pair would be so much smaller in *Nototherium* than in *Diprotodon* as to leave no trace of their sockets in that part of the jaw—viz. beneath the two anterior molars—where the corresponding socket is widely excavated in *Diprotodon*: the difference in the size and position of the incisor-socket was, in fact, such as led me to infer that *Nototherium* did not possess a tooth developed to the degree which is indicated by the term "tusk"†; and the fossil jaw transmitted by Mr. Hughes proves such to be the case, and that the inferior incisor presented the same small proportional size, compared with *Diprotodon*, which the upper incisors of the so-called *Zygomaturus* present. Precisely the same characters which distinguish generically the lower molar teeth of *Nototherium* from those of *Diprotodon* distinguish the upper molars of *Zygomaturus* from those of *Diprotodon*. This concordance is carried out even to the minute markings of the enamel.

With respect to that character in the lower molars of *Nototherium Mitchelli*, I have remarked, "The dentine of the crown is encased in a sheath of enamel of nearly one line in thickness, with a smooth and polished surface, impressed at the outer part and near the base of the tooth, where the enamel is principally preserved, with fine parallel and nearly horizontal transverse lines‡." Precisely the same character is presented by the enamel of the upper molars of *Zygomaturus*. I then proceeded to state, "The smooth and polished exterior of the enamel covering the anterior part of the posterior eminence presents a striking contrast with the reticulo-punctate character of the enamel at the corresponding part of the molar in the *Diprotodon*§." The upper molars of *Zygomaturus* differ in the same way from those of *Diprotodon*.

Besides the well-executed casts of the cranium, and of part

* Drawn on the plate without reversal.

† "The anterior end of the symphysis (fig. 4) is broken away; but there is no trace there of the socket of any tooth; and it is too contracted to have supported any tusk or defensive incisor." (Extinct Mammals of Australia, 8vo, p. 12, 1845.) I erred, however, in supposing that incisors were absolutely wanting in the lower jaw of the smaller species, thence called *Nototherium inerme*: the analogy of the Rhinoceroses, however, supported the supposition that this species might differ from the larger *Nototherium Mitchelli* in the absence of those teeth.

‡ *Ibid.* p. 13. § *Ibid.*

of the upper jaw with upper molars, of the so-called *Zygomaturus*, the British Museum possesses a portion of the right side of the upper jaw with three molars of the *Nototherium* (Pl. IX. figs. 4 and 5), identical, at least in size, general configuration, and in the character of the enamelled surface, with the teeth in the lower jaw of that genus: the same collection also possesses an almost entire lower jaw of the *Nototherium Mitchelli* (Plate IX. fig. 1) from the formations cut through by the Condamine River, in the plains west of Moreton Bay.

I propose first to describe the ramus of the lower jaw of the *Nototherium inerme* (Plate IX. fig. 3), afterwards the almost entire mandible of the *Nototherium Mitchelli* (*ib.* figs. 1 and 2), and finally to point out the resemblances between the dentition of these jaws and that of the fragment of the upper jaw, and the casts of the fossil bilophodont skull, previously described.

The specimen of *Nototherium inerme* (fig. 3) transmitted by Mr. Hughes to the Museum of Natural History at Worcester, from the tertiary deposits forming the bed of the Condamine, consists of the right ramus*, and back part of the symphysis of the mandible, but with the condyloid, coronoid, and angular processes, and the fore part of the symphysis broken away.

The ramus is short, very thick in proportion to its length and especially its depth, convex on the outer side of the dentigerous part, slightly convex vertically on the inner side, and with the lower border describing a convex curve from the condyle to the symphysis, which seems to have been interrupted but slightly, if at all, by any projecting angle; for although the angle has been broken off, it has plainly been bent inward.

The fractured base of the condyloid process presents a triangular form, two inches in its longest diameter: the outer and most obtuse angle forms the hind part of the ridges bounding inferiorly the external coronoid fossa; the upper and most produced angle forms the back part of the base of the coronoid process; the inner and lower angle forms the same part of the angular process.

The outer part of the ascending ramus is divided into two facettes by the first-named thick ridge or rising of the bone, which extends from the outer side of the condyle obliquely downwards and forwards with a curve concave towards the external coronoid fossa.

The base of the coronoid process begins anteriorly one inch external to the socket of the last molar tooth, the hinder half of which tooth would be concealed by the process in a side-view†. The fractured base of the process extends to the condyle, with a slight curve concave outwards; it is about half an inch thick at the beginning, but soon diminishes to 3 lines and then to 2 lines in thickness, the plate of bone being thinned off, as it were, by the depressions for muscular insertion on both its outer and inner sides: it is $3\frac{1}{2}$ inches in extent to where it joins the fractured base of the condyloid pro-

* Drawn on the plate without being reversed.

† This is one of the specific characters of *Nototherium inerme*, given in the "Report," p. 12, and illustrated in pl. 3. figs. 1, 4.

cess. The base of the inflected angle is continued for 2 inches forward and inward from the same fractured base, and there is a well-marked depression on the inner side and above the base of this marsupially inflected angle: a little in advance of it the lower border of the ramus has been produced and slightly bent inwards, for the extent of 4 inches, as far forward as the penultimate molar: owing to its degree of production, which, however, was probably not great*, this inflected ridge or border has been broken away.

The posterior inlet of the dental canal commences at the back part of the thick convex rising which is continued forward on the inner side of the ascending ramus to the inner side of the last alveolus, and which rising divides the inner coronoid surface above from the surangular depression below: the foramen is situated 2 inches behind the last molar tooth, and on a rather higher level than the border of its alveolus: internal to it are a groove and a ridge: it is elliptical in shape, and 5 lines long in diameter: a smooth tract, concave lengthwise, of more than an inch, divides the ridge and the process from the inner and hinder part of the last alveolus, which process has been broken away, together with the border of the alveolus and the crown of the last molar.

The fore and aft extent of the last four molar teeth is 6 inches. Each of these teeth is implanted by two fangs. The fractured surface of the jaw in front of the first of these two-fanged teeth (Plate IX. fig. 3) shows the back part of the smooth vertical socket of a small anterior molar, of which no trace is perceptible in the somewhat more mutilated ramus, specimen No. 1505, on which (in the Museum of the College of Surgeons) the species *Nototherium inerme* was founded†. The fractured anterior surface of the mandibular ramus under description shows also the back part of the socket of a procumbent incisor, which alveolar surface, or bottom of a socket, is in advance of that of the first small molar.

The character of the *Nototherium inerme*, as originally given in my 'Catalogue of Fossil Mammalia' and 'Report,' &c., must be rectified by the addition of a fifth molar—the small anterior one; and of an incisor, shorter and relatively smaller than that of *Diprotodon*, in each ramus of the lower jaw.

The fore part of the dental canal is exposed immediately external to the back wall of the incisor socket, where it is reduced to the diameter of 3 lines.

The depth of the ramus of the jaw behind the symphysis is 3 inches; and it is the same behind the penultimate molar. The thickness of the ramus behind the symphysis is 1 inch 8 lines; but it increases by the convex outswelling of the outer surface to 2 inches 3 lines behind the penultimate molar.

The crown of the last molar (fig. 3, m_3) has been broken away; its base measures, in length 1 inch 10 lines, in breadth 1 inch

* According to the analogy of *Nototherium Mitchelli*, specimen No. 1506 Mus. Coll. Chir., where this ridge is entire.

† 'Catalogue of Fossil Mammalia,' Mus. Coll. Chir. 4to. 1845, p. 314.

3½ lines; this is the anterior lobe; the posterior one is narrower. Each fang is longitudinally excavated at the surfaces next each other; and the outer part of the root, so defined, is thicker than the inner part.

The crown of the penultimate molar is in length 1 inch 9 lines, in breadth 1 inch 3 lines, in height 8 lines: the dentine is exposed at the summit of each ridge.

The two ridges or bilophodont type of the molars of *Nototherium* were indicated rather than demonstrated in the specimens Nos. 1505, 1506, and 1507*, on which the genus was founded. The first complete lower molar which I have yet seen is the penultimate one of the jaw under description†. The crown is girt at the base by a cingulum, developed behind into a low talon, and interrupted at the outer and inner end of the main ridges, and for a greater extent at the inner than at the outer sides.

The horizontal contour of the crown is rather rhomboid than quadrate; for the hind lobe is more internal in position than the front one: and the ridges run, not in a line directly across the alveolar border, but from without inwardly and a little backwardly. The fore part of the outer end of each ridge is a little produced, most so in the hinder one, in which the produced part, inclining inwards, terminates, or abuts below, upon the middle of the base of the front ridge: the anterior part of the inner end of each ridge is a little produced forward, in an angular form; the general result is, that the summit of each ridge is slightly concave forward, convex backward.

The enamel is, for the most part, smooth and polished: the delicate striæ of growth are well marked, when viewed by a pocket lens, on the outer side of the tooth, and the same power brings into view a few punctations on the hinder slope of each ridge: the enamel is rather thicker on this slope than on the front one, and seems more so from being more obliquely abraded, from before downward and backward: so exposed, the coronal surface of the enamel is a line in thickness: the tract of dentine abraded in the present tooth is 2 lines across. The hinder talon, or part of the cingulum, is most developed: the front one seems as if destroyed by pressure of that of the preceding molar.

The antepenultimate tooth, or third counting backwards, measures 1 inch 6 lines in long diameter, and 1 inch 2 lines across the hinder lobe: the talon at the back of this lobe is as well developed relatively as in the penultimate molar: there is the same ridge or production from the outer and front angle of the back lobe obliquely towards the middle of the front lobe: much of this lobe has been broken away. The two fangs of the second molar show a fore and aft extent of at least 1 inch 2 lines for the crown of that tooth, with an extreme breadth of 8 lines. That a still smaller tooth preceded it is indicated, as before remarked, by a part of its socket.

* Mus. Coll. Chir.

† It shows the accuracy of the conjecturally dotted outline of the grinding surface of the entire molars, given in plates 3 and 4 of the 'Report.'

From the evidence of the ramus of the jaw in question, it thus appears that the genus *Nototherium*, as represented by the smaller species, *Not. inerme*, was characterized by at least five molars in each mandibular ramus, and by a procumbent incisor, of less relative size than in *Diprotodon*; its socket not extending back beneath the anterior molar.

From the *Diprotodon* the *Nototherium* differs, in both *Not. inerme* and *Not. Mitchelli*, in the polished surface of the enamel, as contrasted with the reticulo-punctate surface of enamel in the corresponding teeth of *Diprotodon*. *Nototherium* also differs in the oblique production, or ridge, from the outer and fore part of each lobe of the molar; by which it approaches nearer to *Macropus*, where such ridges are more developed.

The second species of *Nototherium* (*N. Mitchelli*) was founded on the posterior half of the left ramus of the lower jaw, now in the Museum of the Royal College of Surgeons (No. 1506, Catal. of Foss. Mam. 4to, p. 316, 1845), containing the last two molar teeth, which differed in their more advanced position, in reference to the coronoid process, from the *Not. inerme*. In a collection of Australian fossil remains, lately acquired by the British Museum*, there is an almost entire lower jaw (Plate IX. figs. 1 and 2), the hinder half of the left ramus of which precisely corresponds in size and shape with that of the *Nototherium Mitchelli*, and the fore part of which also shows the first small single-rooted molar; and in advance of its socket, the base of that of a procumbent incisor, having the same small relative size as compared with *Diprotodon*, which the lower jaw of the *Nototherium inerme* exhibits. The condyloid, coronoid, and angular processes, together with the fore part of the symphysis, are broken away in this specimen.

The back part of the ascending ramus below the condyle is bent or produced inwards, so as to form a deep concavity on the inner side of the base of that process. The inward production subsides, however, before it reaches the ordinary position of the angle of the jaw, from which it is separated by a smooth tract, where the outer surface is continued into the inner surface, without any production. Below this, the thick posterior and inferior border of the ascending ramus is again bent inwards, but in a rather less degree than the part above. The depression on the outer side of the coronoid process much resembles that in *Nototherium inerme*; but the fore part of that process commences at a greater distance external to the alveolar tract, as well as being opposite to the back instead of the middle part of the last molar tooth. A low ridge is continued from the middle of the back part of the socket of that tooth backwards to the process marked *b* in figs. 2 and 3, plate 4, of my original memoir on the genus *Nototherium*, and which is described there as "a broad platform of bone on the inner side of the base of the coronoid process." The entry of the dental canal is situated behind this platform, close to

* At an auction at Messrs. Stevens's, King Street, Covent Garden; and stated to have belonged to a Mr. Boyd.

the coronoid process, and distant from the last alveolus 2 inches 9 lines. The coronoid process has the same extensive fore and aft origin, and the slight transverse diameter as in *Nototherium inerme*, but is rather more concave externally.

The outer side of the horizontal ramus of the lower jaw of *Not. Mitchelli* is as convex as in *Not. inerme*; but it has a greater relative depth compared with the size of the molar teeth: this depth taken at the mid part of the last molar in *Not. Mitchelli* is 3 inches 9 lines: in *Not. inerme* it is only 2 inches 10 lines.

The long (fore and aft) diameter of the last molar in *Not. Mitchelli* is 1 inch 10 lines: the breadth of its front lobe is 1 inch 5 lines. The hind lobe is narrower. The cingulum is interrupted on the inner end, but not on the outer end of this lobe, behind which it swells into a talon of two lines breadth. The cingulum is interrupted at both the outer and inner ends of the front lobe, and is reduced in breadth where it is overlapped, at the outer half of the fore part of the tooth, by the talon of the next molar. The two ridges show the same degree of anterior concavity, and oblique production, of their outer and front angles as in *N. inerme*.

The penultimate molar is 1 inch 9 lines in long diameter, 1 inch 4 lines in breadth; it closely corresponds with that tooth in *Not. inerme*, but has been more abraded in the present specimen. The antepenultimate or third tooth (Plate IX. figs. 1 and 2) is 1 inch 6 lines in long diameter, 1 inch 2 lines across the hind lobe, which is rather the largest.

The socket of the second tooth (*ib.* d_4) indicates it to have had a long diameter of 1 inch $3\frac{1}{2}$ lines. The first tooth (*ib.* p_3) was, apparently, but 5 lines in long diameter, and was implanted by a single fang.

The extent of the five sockets is 7 inches 3 lines; that of the last three sockets is 5 inches 2 lines; the same extent is 5 inches in *Nototherium inerme*.

The back part of the symphysis in *Nototherium Mitchelli* is opposite the interspace between the third and fourth molar; in *Not. inerme* it is opposite the middle of the third molar. A longitudinal extent of 5 inches 3 lines of the symphysis, *i. e.* for $1\frac{1}{2}$ inch in advance of the first molar, is preserved on the left side of the lower jaw here described; and beneath this part the alveolus of the procumbent incisor penetrates to a depth of 1 inch 9 lines: and that socket indicates a somewhat relatively larger incisor than in *Nototherium inerme*; yet one much less, both absolutely and relatively, than in *Diprotodon*. What the entire length of the symphysial part of the jaw has been in advance of the molar series cannot be determined, owing to the unfortunate fracture of that part in the present specimen.

The total length of the left ramus (mutilated at both ends) is 1 foot 2 inches. The breadth of the mandible across the first molar alveolus is 2 inches 6 lines; but the jaw swells out as it descends. In front of this alveolus the jaw contracts suddenly at its upper

border to a breadth of 1 inch 6 lines, and then begins to expand as it advances; this is a very significant evidence of the relationship of *Nototherium Mitchelli* with the cranium of *Zygomaturus*. The sides of the upper symphysial channel, in advance of the first molar, terminate above in a ridge, which is concave outwards, through the lateral contraction in front of the molar series. The anterior outlet of the dental canal is situated 1 inch 3 lines below this ridge, opposite the fore part of the socket of the first molar.

The right and left molar series converge a little anteriorly, with a slight concavity towards each other. From the outside of the socket of the right to that of the left last molar is 5 inches 6 lines; the extreme breadth of the lower jaw at the same part is 7 inches 9 lines, which is due to the great outswelling of the rami at that part. At the under and back part of the symphysis there is a semicircular depression, 1 inch 8 lines, across, bounded anteriorly by a sharp wall, concave backwards.

Such are the chief additional facts relative to the structure of the lower jaw and teeth of the *Nototherium Mitchelli*, which are derivable from the more perfect specimen in the British Museum, as compared with the original, in the College of Surgeons, on which the species was founded. There remains to be determined the degree of correspondence between this lower jaw with its dentition, and the cranium and teeth of the bilophodont marsupial to which the name *Zygomaturus* has been applied.

The photographic figures, and the subsequently received cast of that cranium, showed a well-marked difference from *Diprotodon* in the much greater extent of the anterior origin or base of attachment of the zygomatic arch in the smaller bilophodont marsupial: and this character has served to determine the nature of a portion of the right side of the upper jaw, with three molar teeth, and an almost coëxtensive anterior base of the zygomatic arch (Plate IX. fig. 5) of a similar-sized bilophodont forming part of the collection of Australian fossils in the British Museum. The difference between this and *Diprotodon* is most conveniently exemplified by an almost similar fragment of the right upper jaw, with the anterior base of zygomatic arch (*z*) and a single molar (m_2), with part of the sockets of the preceding and succeeding tooth (*ib.* fig. 6), in the collection of fossils sent by the Natural History Society at Worcester. The difference above pointed out in the surface of the enamel of the lower molar teeth of *Nototherium* and *Diprotodon*, is here as strikingly exemplified in the enamel of the upper molars. The ridges, instead of being directly transverse as in *Diprotodon*, show the same slight degree of obliquity as in the lower molars of *Nototherium*. The summits of the ridges show a slight concavity directed backwards, due in part to the production of the inner and back part of each ridge,—a modification which, from the analogy of *Macropus*, might have been anticipated in the upper molars of *Nototherium*.

The fore and aft extent of the three molars in the present fragment of upper jaw corresponds with that of the three middle molars of the lower jaw of *Not. Mitchelli*; their transverse breadth is greater

in the degree usually noticed in comparing upper and lower molars of the same herbivorous animal. The last of the three upper molars shows the surface produced by the pressure of the tooth beyond it; and its hinder ridge shows the same proportion of minor breadth as in the penultimate molar in the cast of the cranium of *Zygomaturus*.

The cingulum forms a ridge along the back part of this molar, of about a line in breadth: the anterior basal ridge is broader, and of greater transverse extent. The enamel on the worn ridges shows the same thickness as in the lower molars of *Nototherium*. The long diameter of the crown is 1 inch 10 lines, the cross diameter is 1 inch 8 lines. The posterior fang, which is exposed, continues of the same breadth for 2 inches within the socket, without dividing. A linear indentation divides the fang from the back part of the enamelled crown.

The middle (antepenultimate or third) molar ($m\,1$) is 1 inch 6 lines in long diameter, and nearly the same in cross diameter; its anterior talon is also thicker than the posterior one.

The anterior molar ($d\,4$), answering to the second in the lower jaw of *Nototherium*, has the two ridges obliterated and worn down to a common field of dentine, with the enamel-wall thickened and encroaching angularly at the middle of the inner side, where the mid valley ended in the younger state of the tooth. This greater degree of attrition of the permanent tooth in advance of the antepenultimate grinder, is a surer proof of the marsupiality of the great Herbivore than would be the marsupial bones themselves*.

The molar teeth in the cast of the skull of the *Zygomaturus* present, as already remarked, the same configuration as the teeth in the fragment of skull above described: the fore and aft extent of the three corresponding teeth in the cast, viz. the second, third, and fourth, is 4 inches 3 lines: their crowns are less abraded. The portion of bony palate preserved in the fragment of the skull shows the same entireness as in the cast of the entire skull. The three molars exhibit the same slight degree of convex outer, and concave inner, contour as do the corresponding molars in the entire series.

The three molar teeth in the fragment of upper jaw unequivocally belong to the same genus, and almost as clearly to the same species, as do the lower jaw and teeth of *Nototherium Mitchelli*. When the molar teeth in that lower jaw are applied to the molars in the cast of the upper jaw of *Zygomaturus*, it is difficult to imagine that they have not belonged to the same individual animal,—the correspondence is so close. The indication, slight as it is, of an expansion of the symphysial part of that mandible in advance of the constriction at its beginning in front of the first molar, is most satisfactory, as showing the same peculiar feature which distinguishes the short premaxillary part of the cranium.

I conclude, therefore, that the cranium, of which we now possess the cast (Plate VII. figs. 1-4), the fragment of the upper jaw with the molars (Plate IX. figs. 4 and 5), the almost entire under jaw

* The Monotremes have marsupial bones, although no marsupial pouch: the Thylacine has the marsupial pouch, but no marsupial bones.

(*ib.* figs. 1 and 2), and the right ramus of the under jaw (Plate IX. fig. 3) (in the Natural History Museum at Worcester), which form the chief subjects of the present communication, belong to one and the same genus, for which, according to the title of priority, the name of *Nototherium* must be retained.

The entire cranium, the portion of the upper jaw, and the almost entire lower jaw belong to the larger species, or form, of *Nototherium* which I have called *Not. Mitchelli*. The right ramus of the under jaw (Plate IX. fig. 3), and the upper jaw, with the molar series on each side, of which a cast has also reached the British Museum, belong to the smaller species, or form, called *Nototherium inerme*. It remains to be seen whether this may not be the female, and the larger form the male, of the same species of *Nototherium*. The difference of size between the two sexes of the Kangaroos renders the above conjecture extremely probable.

I subjoin the determinations of forty-eight specimens of Australian Fossils, transmitted, at the suggestion of the President of the Geological Society, for my examination, from the Museum of the Natural History Society of Worcester, by the liberality of the Council of that Society. These specimens were collected by Mr. Hughes, in Darling Downs, and exemplify the richness of the fossil evidences of Mammalia, and the association of particular genera in one limited locality.

List of Mammalian Fossils from Australia in the Museum of the Natural History Society of Worcester.

1. Upper jaw of *Macropus Titan*, mas.
2. Lower jaw of *Macropus Titan*, fœm., left ramus.
3. Lower jaw of *Macropus Titan*, right ramus.
4. Lower jaw, *Macropus Atlas*, fœm.
5. Right humerus, *Macropus Atlas*.
6. Lower jaw, *Macropus Ajax*.
7. First
8. Second } phalanges of the middle toe of fore foot of *Macropus Titan*?
9. Third
10. Right acetabulum and part of pelvis of *Macropus Titan*?
11. Right acetabulum and part of pelvis of *Macropus Atlas*?
12. Right acetabulum of *Macropus Anak*.
13. Lower jaw, *Macropus Anak*.
14. Left humerus, *Macropus*.
15. Shaft of part of right tibia, *Macropus Titan*?
16. Upper part of shaft of right femur, *Macropus Titan*?
17. Metatarsus of largest toe, hind foot, *Macropus Titan*?
18. Proximal phalanx of ditto, *Macropus Titan*?
19. Proximal end of right tibia, *Macropus Atlas*.
20. Part of shaft of right tibia, *Macropus Atlas*.
21. Distal end of right tibia of *Macropus Titan*.
22. Distal end of right tibia of *Macropus Titan*, mas.
23. Distal end of left tibia of *Macropus Atlas*?
24. Caudal vertebra, *Macropus Titan*?
25. Caudal vertebra, *Macropus Titan*?
26. Part of left ramus of lower jaw of *Diprotodon australis*.
27. Part of upper jaw of *Diprotodon australis*.
28. Part of right ramus, lower jaw, *Nototherium inerme*.
29. Part of right ramus, lower jaw, *Diprotodon*.
30. Part of right ramus, lower jaw, *Diprotodon*.
31. Portion of acetabulum, *Diprotodon*?
32. Part of a molar tooth, *Diprotodon*.

33, 34. Fragments of ribs (*Macropus Titan*?).
35. Metacarpal, *large Macropus*.
36, 37, 38, 40, 42. Fragments of ribs, *Nototherium* or *Diprotodon*.
39. Shaft of radius, *large Macropus*.
41. Shaft of femur, *large Macropus*.
43. Proximal end of right ulna, *Nototherium* or *Diprotodon*.
44. Fragment of ischium.
45. Caudal vertebra of *Diprotodon*.
46. Right calcaneum, *Macropus Titan*?
47. Proximal half of large metatarsal of *Macropus Titan*.
48. Large metatarsal of *Macropus*.

DESCRIPTION OF PLATE IX.

[The originals of figs. 1, 2, 4, and 5 are in the British Museum; those of figs. 3 and 6 are in the Museum of Natural History, Worcester.]

Fig. 1. Upper view of a mutilated lower jaw of *Nototherium Mitchelli*; one-fourth natural size.

Fig. 2. Side-view of the same jaw. *i*, socket of incisor; *p* 3, first molar, answering to the third premolar of the Diphyodont type; *d* 4, second molar (socket of), answering to the last deciduous molar; *m* 1, *m* 2, and *m* 3, *Nototherium*, answering to the first, second, and third true molars of the same type: one-fourth natural size.

Fig. 3. Upper view of mutilated right ramus of the jaw of *Nototherium inerme*; one-fourth natural size.

Fig. 4. Side view of three teeth, upper jaw, of *Nototherium Mitchelli*; half natural size.

Fig. 5. Under view of the same portion of upper jaw, showing the broad base of the front root of the zygoma; one-third natural size.

Fig. 6. Portion of the upper jaw, with a grinding tooth, showing the narrow base of the front-root of the zygoma, *Diprotodon australis*; one-third natural size.