XXIII. *On the Fossil Mammals of Australia.*—Part IX. *Family* MACROPODIDÆ; *Genera* Macropus, Pachysiagon, Leptosiagon, Procoptodon, *and* Palorchestes. *By Professor* OWEN, *F.R.S. &c.*

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§ 1. *Macropus Titan.*—In illustration of certain fossils from the freshwater beds of the Queensland province, showing the hindmost mandibular molars with characters of the general type of those of the *Macropus Titan*, but with modifications indicative of specific difference, it appears requisite to premise figures and descriptions of the corresponding molars at a similar stage of wear and age, which are plainly referable to *Macropus Titan*.

In the subjects of figs. 13 & 15, Plate XXII. of a former Part*, the last mandibular molar had but recently come into use; the edges of the two main lobes showed the backwardly oblique abrasion of the enamel, but not carried so far as to expose the dentine; the links were entire from their origin at the fore and outer angles of the two lobes; the hind surface of the second lobe showed the whole of the angular fossa on its inner half, and the small faint vertical notch external thereto.

In the subjects of Plate LXXVI. figs. 2, 4, the direction of wear against the upper molar from above downward and backward has extended the abrasion from the second lobe to its hind basal surface, where the bottom of the hind fossa (*g*) alone remains; with the edges of the wedge-shaped lobes the origins of the link (*r*) are gone, and only the lower antero-posterior ends remain, dividing the valley into a smaller outer and a larger inner depression. The prebasal ridge (*f*) is correspondingly reduced in fore-and-aft extent.

That these changes or modifications of working-surface of m_2 and m_3 are due to age and wear will be clear to any one comparing these teeth in Plate LXXVI. figs. 2 & 4, with those before quoted of large full-grown individuals of *Macropus Titan*, described and figured in Part VIII., and with m_3 of fig. 1, Plate LXXVI.

The size and form of the portions of mandible preserved closely agree with those of the corresponding parts of the more entire mandibles of *Macropus Titan*, figured in Plate XXII. figs. 13 & 15 and Plate XXVI. figs. 11 & 13 of Part VIII. And I here subjoin a view from above (Plate LXXVI. fig. 1), not before given, of the subject of the last-cited figure, to illustrate the correspondence in the breadth and direction of the "ectalveolar groove" (*u*) and in the thickness of the mandible, including the fore part of the base of the coronoid, with corresponding parts of the bone from the more aged animals that have afforded the subjects of figures 2 & 4, Plate LXXVI.

* Part VIII., Philosophical Transactions, 1874, p. 256.

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The only difference of note is in the more advanced position of the last molar; and this is due to the well-known general forward movement of the serviceable teeth when those anterior to them have been worn down and shed—a movement which reaches its maximum in the Elephants.

§ 2. *Macropus Ferragus*, Ow.—A portion of a right mandibular ramus with the last two molars in place and worn (Plate LXXXI. fig. 4, and Plate LXXXII. figs. 3 & 4) indicates, both by the size of the teeth and that of the jaw itself, a Kangaroo too much exceeding in size the largest individuals of *Macropus Titan* to belong to that species. A comparison of the above-cited figures with figures 13, 15 in Plate XXII. of the previous Part* will demonstrate this fact.

The jaw-bone of *Macropus Ferragus* is relatively thicker in proportion to the teeth, and the last molar (Plate LXXXII. fig. 3, m_3) rises more in advance of the origin of the coronoid process; but this may relate to the greater age of the individual as shown by the exposure of the dentine in both lobes (ib. fig. 4) of that tooth, though they are not worn to quite the same degree as in fig. 2, Plate LXXVI. The base of the notch (Plate LXXXII. fig. 4, *g*) remains on the hind part of m_3, and internal thereto are indications of two vertical ridges which I have not found in any fossil of *Macropus Titan*.

§ 3. *Pachysiagon*† *Otuel*‡, Ow.—In the portion of right mandible with the three hindmost molars (Plate LXXVI. figs. 7–10), in which the dentine is exposed on the summits of the lobes of m_3 and in the usual proportionally greater degree in m_2 and m_1, the three molars, corresponding in fore-and-aft extent with those in *Macropus Titan* (Plate XXVI. fig. 9, Philosophical Transactions, 1874), and only exceeding by a line the same teeth in the subject of figure 11, Plate XXVI., ib., are implanted in a jaw of considerably greater thickness. This jaw likewise shows a wider ectalveolar channel (Plate LXXVI. fig. 9, *u*); the anterior border of the base of the coronoid also rises more vertically and more in advance of the last molar, a difference not to be accounted for by age, as is manifest in a comparison of the present fossil with the mandible in younger individuals of *Macropus Titan*.

With these mandibular indications of, at least, specific distinction, the molars themselves show the following differences. The prebasal ridge does not extend so far forward as in *Macropus* proper; the hind surface of the molars has two vertical narrow grooves, to which a third shorter and feebler one is added in m_3 (ib. fig. 10, *g*). These grooves do not extend below the base of the transverse lobe, and below them the common base of the crown of the tooth rises smoothly and convex for a line and a half clear of the socket; the innermost notch is very little deeper or wider than the next—contrasting strongly with the large and deep notch on the inner half of the hind surface of the molars in *Macropus Titan*, which descends nearer to the origin of the hind fang of the tooth.

Another character is shown in the mid link (Plate LXXVI. fig. 9, *r*), which sends off

* Philosophical Transactions, 1874, p. 245.

† From παχὺς, thick; σιαγὼν, jaw-bone.

‡ A giant in the 'Romance of Roland and Ferragus.'

from the inner side near its termination in the hind lobe a short and low ridge of enamel passing downward, forward, and inward to be lost in the inner division of the transverse valley. There is likewise a small vertical ridge of enamel from the fore part of the hind lobe, internal to the link and its accessory process, which ridge descends straight to the bottom of the valley. These productions of enamel cause corresponding complexities of the grinding-surface, which are correlatively associated with the more massive bone wielding the grinding-instruments.

On the inner surface of this portion of mandible (Plate LXXVI. fig. 8) the super-angular channel (ib. *b*) is shorter, deeper, defining a narrower and shorter beginning of the inflected angle than in *Macropus*, the channel commencing anteriorly at a vertical parallel with the interval between the last and penultimate molars. By the above-defined characters I infer from the present fossil a distinct subgenus of *Macropodidæ*, for which the massiveness of the mandible in proportion to the teeth it supports has suggested the name above given.

§ 4. *Leptosiagon* gracilis*, Ow.—On similar grounds the present genus and species of extinct Kangaroo are based upon a portion of a right mandibular ramus with m_1 and m_2 in place, part of the socket of m_3, and the whole of that of d_4, from which the tooth appears to have been naturally shed or worn away (Plate LXXVI. figs. 11–15). The transverse fracture of the mandible anterior to d_4 (ib. fig. 15) shows the bone to be unusually thin in proportion to its depth; the partial thickening on the inner side is almost ridge-like; the outer thickening, beginning opposite the inner one, is continued with a convex curve to the lower border of the ramus.

The distinctive dental character of the present subgenus is in the sculpturing of the hind surface of the molars (ib. fig. 14); two slender well-defined pyramids of enamel, in high relief, rise from the base of that surface at its inner half, and terminate in points, the inner one within a line of the unworn summit of the hind lobe, the outer one within two lines of the same. A deep reversed, narrow, angular or pyramidal notch divides the inner pyramid from the inner side of the hind lobe, a deeper notch of corresponding form divides the inner from the outer pyramid, and a fainter, narrow, short, linear groove separates the outer pyramid from the rest of the outer part of the hind surface, which is continued by a bold convexity into the outer side of the molar.

The outer end of both transverse lobes incline more forward than in *Macropus Titan*; but, as in that species, the outer bases of the two lobes meet to define an acute-angled pointed lower termination of the interval or valley there (ib. fig. 11, m_1, m_2). In *Sthenurus* and *Protemnodon* the lower termination of the same interspace is rounded, not pointed, the outer bases of the lobes not being in the same degree extended antero-posteriorly.

There is no accessory ridge from the inner side of the mid link; but in the smaller outer part of the hollow between the front lobe and the prebasal ridge, defined by the fore link, there is in m_2 a vertical enamel ridge: it is not present in m_1 (Plate LXXVI. fig. 13).

* From λεπτὸς, slender; σιαγὼν, jaw-bone.

I have seen none such in the corresponding part of any molar of *Macropus Titan*; and it may be a variety in the individual specimen exemplifying or indicating the present subgenus.

But the character of the back part of the molar is decisive, so far as my present observation of existing and extinct Kangaroos has extended, of the taxonomic distinction which I have assigned to *Leptosiagon gracilis*.

§ 5. Genus *Procoptodon**, Ow.—The indications of this genus, at first fragmentary, have been raised, by evidences successively received since the year 1845, to demonstration, under, at least, three specific modifications.

The first of these is exemplified, mainly, by maxillary fossils. The most instructive are portions of the right and left maxillary bones, each with three molars ($d\,4$, $m\,1$, $m\,2$) and part of a fourth, $d\,3$ (Plate LXXVII. figs. 2–6), of the same skull.

In antero-posterior extent and in breadth the two molars ($m\,1$, $m\,2$) do not exceed their homologues in the upper jaw of *Sthenurus Brehus*†; but the configuration of the grinding-surface is different and much more complex, of itself indicating a distinct genus if not subfamily of *Macropodidæ*.

The prebasal ridge (*f*) is narrower than in *Sthenurus*; it descends (the tooth being viewed prone) from the fore part of the outer angle of the front lobe (*a*) and then passes inward with a slighter descent to the fore part of the base of the inner half of the front lobe, subsiding before attaining the inner side of that lobe. The fore link (*s*) is feebly represented by a vertical ridge on the fore part of the front lobe, nearer its outer than inner end, the rest of that fore surface being marked by more minute vertical ridges and grooves. The hind surface of the front lobe is bounded by sharp subvertical ridges, respectively descending, with a slight degree of convergence, from the hind part of the outer and inner angles of the front lobe. In the transverse concavity of the hind surface of that lobe, so bounded, two stronger sharp vertical ridges of enamel descend toward the intervening valley, the outer ridge being continued backward across the valley as the 'mid link' (*r*), with a slightly sinuous course, convexly outward. The hind surface of the hind lobe (ib. fig. 5, $m\,2$) almost repeats the characters of that of the front lobe; the inner (*g*) of the two submedian vertical ridges in the concavity of such surface expands at its base into the convexity of that part of the molar; the outer submedian ridge is minute. From the outer lateral or boundary-ridge a sharp vertical plate of enamel (*h*) is directed inward, and there are some minor sculpturings of this part of the hind surface. Its basal part is somewhat bulging and smooth, as are the outer and inner swollen ends of the two main transverse ridges or lobes (ib. fig. 6, *a*, *b*).

The second molar ($m\,2$) is rather larger than the first; both are feebly abraded along the fore part of the transverse summits of the wedge-shaped lobes, but not so far as to expose the dentine; both teeth are behind the back surface of the masseteric process ($21''$). These signs of immaturity were associated with and confirmed by the presence of

* From πρὸ, before; κόπτω, to pound; ὀδοὺς, tooth.

† Philosophical Transactions, 1874, Plate XXVII. fig. 6, $m\,1$, $m\,2$.

the undeveloped and unextricated premolar (ib. figs. 2, 3, 4, p_3); it was so far advanced as to have pushed its crown to near the level of the base of d_3, at the interval between the diverging pairs of the fore and hind fangs of that deciduous tooth (ib. fig. 6, d_3). The major part of d_4 had been broken away on the right side, but the crown remained in the left maxillary. The mid link and the accessory ridge are here present, and the hind surface of the second lobe shows the complex accentuation, which is further carried out in the succeeding teeth. On the summits of both lobes of d_3 and d_4 the dentine had been exposed by masticatory abrasion.

The thin smooth partition-wall between the sockets of m_2 (the hindmost tooth in place) and of m_3 was manifest at the back part of each maxillary (fig. 5, m_3), confirming, with the more decisive evidences at the fore part, the homologies of the more or less complete teeth, and demonstrating the immaturity of the individual from which the fossils had been derived; the usual process for exposing the premolar had the usual result.

The crown of the premolar (ib. figs. 2, 3, 4, p_3, and fig. 7, p_3), in its antero-posterior extent, resembles that of *Macropus* proper, not being quite equal to that of the crown of the next tooth (d_4); but it is thicker transversely than in *Macropus* or *Sthenurus*, with a transversely ridged complexity of the broad working-surface between the outer (*a*) and inner (*b*) longitudinal ridges or walls (fig. 7), which shows it to have acted as a pounder rather than a divider of the vegetable food, a character which suggested the name proposed for the genus (Note *, p. 786).

The vertical extent of the enamelled crown of the premolar does not exceed the breadth of the hind part of the tooth. The outer surface shows three conical elevations, in low relief, of the enamel, one behind another (fig. 2, p_3). The apex of the foremost constitutes the anterior prominence of the outer longitudinal ridge; that of the second slightly projects from the middle of that ridge (*a*, p_3, fig. 7); that of the hindmost one subsides before it gains the ridge, which is continued, sharply, upon the outer and back part of the crown of the premolar. The foremost of the three conical low reliefs of the enamel forms the outer part of the fore swollen end of the crown (fig. 4, p_3), which is divided by a depression from the lower and narrower, basally swollen beginning of the inner longitudinal ridge (*b*). This slightly diverges as it recedes from the outer ridge, obeying the hinder enlargement of the crown, and it is united near that end by a transverse ridge with the outer longitudinal one. The transverse ridge is a miniature or rudiment of a hind lobe, and its hind surface is excavated and ridged in a feeble or rudimental way like that part of the normal hind lobe of the bilophodont molars. The horizontal triturating surface of the premolar between the outer and inner longitudinal ridges is sculptured by transverse sharp enamel-ridges and deep depressions.

There is a character in the upper jaw of *Procoptodon* which is not present in the large existing Kangaroos of the subgenera *Macropus* and *Osphranter*. It is present, under some modifications, in *Boriogale* and in the smaller Kangaroos or Wallabies of the subgenera *Halmaturus* and *Petrogale*. I find, indeed, in *Petrogale xanthopus*, Gd., and *Halmaturus brachyurus*, Wth. (Plate LXXVII. fig. 1, *b b*), the

nearest approach to the structure in question. It is a large unossified tract of the palate, shown in both maxillaries of the fossil (Plate LXXVII. fig. 6, *b b*) by the passage of the palatine (fig. 3, 21) into the nasal (*n*) plate at a distance of from 2½ lines to 3 lines from the inner wall of the alveoli of *d* 4, *m* 1, and *m* 2. This upward bend of the palatal plate (ib. fig. 3, *n*) is at nearly a right angle with the narrow horizontal palatal strip, and in both maxillæ the continuation of the nasal plate of the maxillary into the orbital one by the large spheno-palatine foramen (fig. 3, *s*) is shown.

Arrested ossification of the palate is, however, a marsupial rather than a macropodal character, and is exemplified, in my "Osteology of the Marsupialia"*, in the Thylacine, the Sarcophile, the Dasyure, the Bandicoots, the Peragale, and the Potoroo, as well as in a small species of Kangaroo (*Halmaturus Bennettii*). In this species the palatal vacuities are four in number, in two lateral pairs†. In *Halmaturus brachyurus* (Plate LXXVII. fig. 1, *b b*) the intervening strip of bone between the fore and hind vacuity is wanting, and each pair is blended into one large lateral unossified tract, which either falls into its fellow, or is separated from it by a mere filament of bone. Such was the structure in the great procoptodont Kangaroos, the vacuity, moreover, extending more forward than in *Halmaturus* or *Petrogale*.

I need scarcely say that the dentition of the small existing species of these genera is of the ordinary halmatural type; the premolar is trenchant, the inner ridge being low or 'basal.'

The front pier of the zygoma (Plate LXXVII. figs. 2–5, 21′, 21″), extending from the fore part of the orbit obliquely downward and backward, terminates below, in the present immature specimen of *Procoptodon*, above the interval between *d* 4 and *m* 1; it might recede in relative position to the molar series when this was fully in place; but so much of the pier as is preserved is more compressed, and stands out relatively further than in any existing Kangaroo. I shall subsequently be able to show that the more advanced position of the descending masseteric process is constant at all ages in *Procoptodon*, and may be added to the palatal and dental characters of the genus.

§ 6. *Procoptodon Pusio*.—These characters, as above defined, added to size, exemplify the present species.

The antero-posterior extent of the three molars *d* 4, *m* 1, *m* 2, Plate LXXVII. in the subject of figures 2, 3, 6, is 1 inch 10 lines; the four teeth, the premolar being in place, would reach along 2 inches 4 lines: taking the fore-and-aft diameter of the last molar, *m* 3, to equal that of the penultimate one, *m* 1, here in place, the permanent upper molar series of *Procoptodon Pusio* (ib. fig. 7) would be 3 inches 2 lines in longitudinal extent. All things being equal this Kangaroo was one third larger than *Osphranter robustus*, Gd.‡

§ 7. *Procoptodon Rapha*, Ow.—The size of the premolar (Plate LXXVII. fig. 8, *p* 3) in the fragment of lower jaw of the immature *Procoptodon* next to be described indi-

* Zoological Transactions, 4to, vol. ii. part 1, 1838, p. 388, plates 70 & 71. † *Op. cit.* pl. 71. fig. 5.

‡ Compare figure 7, Plate LXXVII. with figure 3, Plate xxi., Philosophical Transactions, 1874.

cates it to have come from another and larger species than *Procoptodon Pusio*, yet of inferior size to *Procopt. Goliah* (Plate LXXX. fig. 7, p_3); the shape of the incisor indicates likewise a difference of species.

The size of the remains of the two anterior fully developed molars (Plate LXXVII. fig. 8, d_2, d_3), in proportion to the jaw supporting them, suggested immaturity, and the excavation of the bone beneath them exposed the crown and beginning of the fangs of a large and thick premolar, of the crushing type of the present genus.

The outer part of the crown (ib. fig. 8, p_3) is divided into two subequal lobes by a marginal notch, from the apex of which a linear groove is continued down the outer side of the crown. The height of this is 6 lines, the fore-and-aft extent is 7 lines; the breadth behind is 5 lines. The crown bulges out above the roots, the hinder one of which bifurcates 6 lines below the crown. The enamel is smooth, white, and the exposed parts show more or less convexity.

The base of the broken crown of the first deciduous molar (ib. fig. 11, d_2) is triangular, with the angles rounded off and the base turned backward; the length of the triangle is 4 lines, the basal breadth 3 lines. The base of the next bilophodont tooth (d_3) is subquadrate, $5\frac{1}{2}$ lines in length, 5 lines in breadth.

The diastemal tract (figs. 8, 9, & 11, *l*, *s'*) has a characteristic shortness; it is continued with, at first, a feeble concavity almost straight on to the outlet of the incisive alveolus, to which it slightly bends down. The outlet of the dental canal (fig. 8, *v*), about 2 lines below the diastemal border, would be about 7 lines from the alveolar outlet were this entire. The lower or symphysial border (figs. 8, 9, *s*, *s''*) rises to the alveolar outlet at a less open angle with the lower border of the horizontal ramus than in *Sthenurus**. The syndesmotic articular surface is flat, rough, and is continued, well defined, to the outlet; it indicates the generic firmer union of the rami than in the type Kangaroos, and a greater development of the uniting or binding structure than in *Sthenurus*†.

The thickness of the ramus at the formative cell of the premolar, in *Procoptodon Rapha*, is $10\frac{1}{2}$ lines (Plate LXXVII. fig. 10). The base of the incisor (ib. figs. 8 & 9, *i*) indicates a tooth of less relative thickness than in *Procoptodon Goliah*. The fractured end gives an ovoid section $5\frac{1}{2}$ lines in vertical, 3 lines in transverse diameter; the outer side is moderately convex, the inner side less so: both upper and lower borders are thick and obtuse; a thin coat of enamel extends from the lower upon the outer sides of the tooth. The shape of the working crown cannot be inferred from the basal part here preserved; but this shows faint longitudinal broad impressions on the outer side, and also that the incisor must have risen obliquely upward at a low angle (140°) with the horizontal line of the molar series.

Thus the present, like the following evidence of the genus *Procoptodon*, indicates, with the shortness and depth of the symphysial part of the jaw, the thickness of the crown of the lower premolar especially behind, and the thickness and apparent depth

* Philosophical Transactions, 1874, Plate xxii. fig. 6. † Ib. ib.

of the ramus, a nearer approach to the characters of *Nototherium* than is shown in any of the foregoing extinct genera of the Macropodal group of Marsupialia.

What is wanting in the above-described fragment of jaw with the small proportion of dentition, by which is indicated a second species of *Procoptodon*, has been supplied by a plaster cast and photographs of an almost entire right ramus, with the molar series. The complex characters of the hindmost and least worn teeth (Plate LXXVIII. fig. 3, m_2, m_3) unmistakably repeat the generic type of those of the upper molars of *Procoptodon Pusio* (Plate LXXVII. fig. 7); but the difference of dimension is, to my experience, specific; and since it is in degree that shown by the premolar germ in the fragment of immature jaw (Plate LXXVII. fig. 8), I regard the specimen in the Sydney Museum, from which the cast and photographs were taken, as part of a mandible of a mature individual of *Procoptodon Rapha*. The longitudinal extent of the upper molars (d_4–m_3) in *Proc. Pusio* is 2 inches 6 lines; that of their homotypes in the mandible of *Proc. Rapha* is 3 inches. The breadth of these lower molars similarly exceeds that of the upper ones in the subjects of Plate LXXVII. figs. 6, 7, which is fatal to the hypothesis of those of Plate LXXVIII. belonging to the same species.

The mandibular ramus of *Procoptodon Rapha* is short, straight, deep, and thick, in the latter dimension (fig. 3) increasing from the symphysis to the ascending branch more gradually but to a greater extent than in preceding genera of Kangaroos. The lower border is convex across, thickest behind the symphysis, and suddenly becomes thinner at its hinder third (ib. fig. 2, *d*, *d'*), where a longitudinal channel (ib. *b'*) along its inner side gives it the appearance of being slightly inflected that way; but the channel (*b'*) is interrupted by a more sudden or direct inflection of the proper "angle of the jaw" (ib. *a*), which here, as in the other macropodal fossils, has been broken away.

The fore border of the symphysial end of the ramus bends up at about an angle of 135° with the axis of the mandible. On the outer side (ib. fig. 1) the alveolar tract is impressed by an irregular longitudinal moderately deep channel, below which the bone swells out and the vertical convexity to the lower border augments from below the first molar (p_3) to the origin of the coronoid process (*q*). A little way behind the anterior border of this process it is feebly impressed, or the surface subsides; but the low rough ridge (fig. 1, *h*), indicative of the lower boundary of the ectocrotaphyte fossa, is at a higher level.

The ramus gains slightly in depth or vertical extent from the groove (*b'*, fig. 2) to the symphysis (*s*, *s'*). The articular syndesmotic surface is broad, strongly roughened and sculptured, and extends from the lower border of the ramus (*s*) to the outlet of the incisor (*i*); the hind border of the symphysial surface is feebly impressed, as in *Phascolomys* (Philosophical Transactions, 1872, Plate XXI.).

The union of the two rami must have been firm, not admitting of any reciprocal movement; indeed the fore part of the joint had become obliterated by anchylosis, and part of the left ramus is here adherent in the fossil. The inner surface of the ramus is almost flat to where it bends to the under border; the narrow continuation forward of

that surface between the symphysial joint and the diastemal tract (fig. 2, *l*, *s'*) is traversed by a ridge, between which and the joint is a narrow groove. The hind part of the ectalveolar groove (fig. 3, *u*) is deep and moderately wide; the postalveolar angle (ib. *t*) is better marked than in the type Kangaroos.

The crown of the premolar has been worn or broken off in the original of Plate LXXVIII.; the length and breadth of its base are the same as in the undeveloped lower premolar (Plate LXXVII. fig. 6, p_3). The strong fore and hind roots are longitudinally striate.

The crown of d_4 is worn down to the base; each lobe shows a broad tract of dentine united by a linear tract along the remains of the mid link. The third tooth (m_1) shows a broad prebasal ridge; the fore link has been worn down to its base, and the dentine there is continuous with that exposed on the anterior lobe. The tract continued along the mid link to the hind lobe is much narrower, being finely linear. A ridge from the inner side of the link is indicated, and a second ridge from the fore part of the hind lobe internal to the confluence therewith of the link. Indications of the procoptodont sculpturing of the back of the hind lobe are unmistakable, but the pattern is better shown in the succeeding molars; the outer and inner smooth convex enamelled ends or sides of the hind lobe are continued a short way upon the back of that lobe and terminate there in well-defined borders, between which the surface sinks. This broad, shallow fossa is divided in two by a pyramidal process of enamel in low relief, the basis below being coextensive with the breadth of the fossa, the apex reaching to the working ridge, in its present degree of wear, of the hind lobe of the last molar.

In the penultimate tooth (m_2) the greater degree of wear gives a strong undulatory course to the enamel-ridge bounding behind the working-surface of the complex molar.

From what may be discerned, in the cast, of the implanted base and outlet of the socket of the incisor, that tooth was relatively small, as in the subject of Plate LXXVII. fig. 8, and was directed obliquely upward and forward at nearly the same angle as that of the posterior border of the symphysis; but the cast does not supply safe data for further particulars.

We have thus in the foregoing evidences of the singular phytophagous Marsupial genus, with the dentition, as to the formula and fundamental pattern of the molars, of the bilophodont *Macropodidæ*, the extremest deviation from the characters of the existing subgenera which the fossil remains of the family have yet exhibited.

I infer from the proportions and shape of the mandible that the rest of the skeleton may have presented a more robust character, with thicker and shorter extremities and with less inequality between the fore and hind pairs of limbs than in the living Kangaroos. Of these, as before remarked, *Procoptodon Pusio* must have exceeded in bulk the largest known. This excess is greater in *Procoptodon Rapha*. But the following fossils show that their generic modifications have been exemplified on a more gigantic scale.

§ 8. *Procoptodon Goliah*, Ow.—The present extinct species of *Macropodidæ* was

first indicated by a fragment of a maxillary bone with three molars, transmitted to me by Sir THOMAS L. MITCHELL, C.B., in 1844.

As the two smallest of these measured rather more than one inch and a half in the antero-posterior direction, and the least transverse diameter was $7\frac{1}{2}$ lines, I provisionally assigned to the species the name "*Macropus Goliah*," and communicated my brief notes on the fossil to my friend and present colleague, GEORGE R. WATERHOUSE, Esq., at that time engaged in his excellent work, 'The Natural History of the Mammalia'*. The type specimen is figured in Plate LXXIX. fig. 1.

My hopes of further elucidating the singular extinct gigantic Kangaroo so indicated have been, through the kindness of friends and correspondents in Australia, abundantly fulfilled. The grounds of the formation of a distinct genus of *Macropodidæ*, of which the "Goliah" is the type, are given in the section (§ 5) descriptive of the smaller species, *Procoptodon Pusio*. As in that species, the two lobes of the molar (Plate LXXIX. fig. 1, m 1, 2, 3) have a more regular elliptic basal section than in the foregoing genera; their outer and inner ends are more convex or bulging; they are not separated by so deep a valley, and this lodges a greater proportion of hard enamel in the form of irregular subundulate ridges, affecting mostly the longitudinal direction, the chief of which may, however, be homologized with the mid link of more normal Macropods. The fore surface of the front lobe and the hind surface of the back lobe are similarly sculptured by irregular ridges, of which two are more conspicuous than the rest at the back of the molar, within a depressed area defined by the abrupt sharp margins, inflected upon that surface of the outer and inner convex ends of the hind lobe. The unworn summits of both lobes are less regularly or extensively transverse than in ordinary Kangaroos, the inner angle curved backward. There is a low and short prebasal ridge, but no such definite production from the back part of the hind lobe.

The fore pier of the zygoma, at least so much of the hind part thereof as was preserved in the present fragment, stands out opposite the antepenultimate tooth (m 1), and its hind curve subsides before reaching the last molar. The narrow plate extending from the palatal wall of the alveoli terminates in a smooth and seemingly natural border. But this and other characters of the species are more fully and plainly illustrated by the specimens next to be described, of which I commence with the portion of a left maxillary, forming the subject of figures 2, 3, 4 of Plate LXXIX.

This portion of jaw retains the five permanent molars (p 3 to m 3), but with some mutilation as well as wear of their crowns. The fore pier of the zygoma (ib. fig. 2, 21″) springs out above the interval between the second (d 4) and third (m 1) molars; and as the last (m 3) is in place and shows wear, it may be concluded that this anterior portion of that pier is characteristic of *Procoptodon*.

On the palatal surface of the bone (ib. figs. 3 and 4) the evidence of the same large vacuity as is indicated in the smaller species (*Procoptodon Pusio*, Plate LXXVII. fig. 6) is unmistakable. The anterior ridge begins to curve to join its fellow opposite the

* Part 2, *Macropodidæ*, 8vo, 1845, "*Macropus Goliah*, Ow.," p. 59.

second molar (d_4), the junction taking place at the mid interval between the right and left premolars (p_3); the posterior ridge similarly bridges the palate between the alveoli, right and left, of m_2 & m_3, fig. 4, Plate LXXIX.

On the working-surface of the crown of p_3 the transverse ridges of enamel along the tract occupying the fore and inner part of that surface appear. This tooth is broadest behind; it is supported by three stout fangs; the foremost diverges from the hind pair as it ascends into the substance of the jaw, where two thirds of an inch of it is exposed; it is thick, and the cemental coat is longitudinally and irregularly striate.

At the back part of m_1 two of the deep vertical notches (ib. fig. 9, *h*) and the intervening strong ridge of enamel (ib. *g*) are conspicuous. The fore link (*s*) and the accessory link to its inner side, also the mid link and the accessory ridges on the surfaces of the lobes internal to it, are shown. The prebasal ridge (*f*), with the fore link (*s*) of the last molar (m_3, fig. 4), has been broken off and slightly displaced from the rest of that tooth, in which the indents and ridges on the hind surface are well displayed. At every part of the worn and fractured surface of this molar series the stalactitic-like complexity of the thick and hard enamel is exemplified. The figures being of the natural size preclude the need of giving dimensions of the several teeth.

In the smaller portion of maxilla and molar series (Plate LXXIX. figs. 5, 6, 7) the coronal modifications of m_1 and m_2 are instructively displayed. Viewing the working-surface from above, the postbasal ridge seems to be represented by a short bar of enamel (figs. 7 & 9, *g*) supporting the bases of the narrow but strongly developed pyramidal ridges (ib. *h*), sending their apices to the working-surface of the hind lobe; but the basal bar does not project like a true basal ridge from the hinder convex surface of the crown (fig. 9).

The correspondence of the complex pattern of the crown of the lower with the upper molars, combined with the usual modifications of greater length of the prebasal ridge, is patent in the subject of figs. 1 & 2, Plate LXXX. In this fossil the last molar (m_3) had but recently risen into place, and the antecedent one (m_2) showed slight traces of abrasion. In d_4 the front lobe (*a*) is narrower than the hind one (*b*); these proportions are reversed, but in a minor degree, in the last molar (m_3). The fore (*s*) and mid (*r*) links are well defined. Deep clefts on the back of the hind lobe mark out the vertical ridges of enamel, of which one is shown at *g*, fig. 2. The base of the coronoid process (fig. 1, *q*) advances forward a little beyond m_3.

The characters of the lower molars of *Procoptodon Goliah* are further exemplified in a smaller fragment of a large, apparently male, animal, with the last two molars showing a greater degree of wear. This specimen (Plate LXXX. figs. 3 & 4, Plate LXXIX. fig. 8), now in the Museum of Natural History of Sydney, New South Wales, has been made known to me by a good plaster cast. The penultimate molar (m_2) is slightly worn, the last (m_3) in a less degree; but both had been in use and indicate a full-grown though not old individual.

The prebasal ridge (ib. ib. fig. 8, *f*), commencing externally at the outer and fore

part of the base of the front lobe, rapidly rises as it curves inward, and extends as a thick ridge three lines in advance of the front lobe, rising nearly to its level, and assuming more of the character of an accessory lobe than a mere basal ridge or developed portion of the "cingulum." Its lobular appearance is strengthened by the well-developed link (*s*) which connects its outer angle with the fore part of the front lobe (*a*) near its swollen end. The accessory ridge (*n*), internal to the link, is well marked, but subsides before reaching the prebasal ridge. This sinks more gradually and with less loss of thickness to the inner and fore part of the base of the front lobe than at its outer end or beginning. The anterior surface of this lobe is broken by minor and less regular ridges and grooves of enamel. The mid link (*r*) has the same relative position to the transverse eminences it connects as has the fore link; the inner accessory ridge (*o*) subsides in the valley; smaller subsidiary ridges and grooves accentuate and multiply the hard enamel-constituent of the grinding-surface of the lower molars, as in those of the upper jaw.

The last molar (*m* 3), with a very slight decrease of breadth of the hind lobe, repeats the characters of the preceding tooth; in both, the hind surface (Plate LXXIX. fig. 10) is impressed with a pair of narrow conical excavations, with apices not reaching to the basal beginning of the crown; these impressions define or leave three ridges (*h*), not extending back beyond the smooth basal part of the tooth, but which, when worn down to near that part, give a strongly undulating course to the enamelled summit of the hind lobe of the molar.

The most complete example of a lower jaw of *Procoptodon* is that which was presented to the Museum of the Royal College of Surgeons of England in the year 1853, by Dr. Falder, with a note of its discovery in the freshwater or drift beds of Darling Downs, Queensland, "at a depth of 40 feet from the surface of the soil."

Each ramus of the jaw is preserved as far as the beginning of the horizontal branch; a small portion of the alveoli of the two incisors, with the corresponding part of the diastemal ridges, has been broken away; the lower border of the right ramus has likewise suffered. But the most instructive element in the jaw, viz. the molar series, is almost entire in both rami.

This series includes six teeth. The last molar is represented by a partially developed crown in its formative cell; the next in advance is not fully risen into place, and the summits of its two lobes are unworn. The antepenultimate molar, with these ridges just touched, shows on each a polished linear tract of enamel; the three anterior teeth, with progressively increasing degrees of wear and decrease of size as they precede in position, are therefore deciduous molars. Of this phase of dentition, as seen from the outer side view of the right ramus, a figure is given in Plate LXXX. fig. 6.

The foremost tooth (*d* 2) shows a working-surface of a triangular form, the base turned backward, the apex forward and obtuse. The outer border has a submedian notch corresponding to a groove terminating there, which divides the outer surface into a fore and hind lobe, both of which are convex transversely, and in a minor degree vertically.

The inner side of the tooth is flatter, and is impressed at its middle third by three shallow parallel grooves descending rather obliquely backward. The coronal ends of these grooves give a crenate character to that part of the enamel. A field of dentine is exposed on the broader hind lobe.

The crown of the second molar (Plate LXXX. figs. 6 & 7, d_3) has the two transverse lobes and a prebasal production; a continuous tract of dentine is exposed on these parts and along the mid link connecting the two lobes. Certain longitudinal impressions on the outer surface of the crown give a wavy character to parts of the peripheral coat of enamel on the working-surface of the tooth.

The third molar (d_4) is mutilated by fracture in both rami, but least so in the right. The prebasal ridge is narrow transversely in proportion to its length; its enamel coat is indented; the fore limb is feebly indicated. The hind surface of the hind lobe shows three vertical enamel ridges, two of which attain the grinding-surface. The mid link is strengthened by a vertical ridge on its inner side.

In the fourth molar (m_1) the prebasal ridge has a distinct link passing from its outer angle toward the middle of the fore part of the front lobe, ending nearer the outer side. Short ridges project from this surface on the inner side, marked off by the fore link. The mid link passes from near the outer side of the fore lobe to near the middle of the hind lobe. The link is complicated by a vertical ridge or fold of enamel on its inner surface. Similar ridges mark the inner half of the fore surface of the hind lobe. On the hind surface of this lobe, internal to the ridge by which the outer convex end there terminates, is a narrow pyramidal tract of enamel in low relief, the apex of which reaches the working-ridge of that lobe; internal to this pyramid is a second, less strongly defined by two sharp linear grooves. The inner side or end of each transverse lobe is narrower.

The fresh and unworn crown of the penultimate molar (m_2) shows well the accessory ridges which complicate the enamel cap of its crown. In this tooth, as in m_1, the prebasal ridge beginning near the base of the inner end of the fore lobe curves forward and outward, rising rapidly to a narrow summit, which seems to represent a third short transverse lobe; this, as soon as it has received or sent off the fore link, subsides suddenly upon the base of the fore lobe before attaining its outer end.

The position of the germ of the last molar is such that the transverse lobes turn their working-edges obliquely inward, rather forward, and, with but a very slight inclination, upward, indicating the semirotating movement by which, in the course of the growth of both tooth and jaw, the crown is brought into the latter direction, and in a working line with the antecedent grinders. The superadded complexities noted in these teeth are multiplied in the last molar; at least so much of the hind surface of the hind lobe as is formed shows, in the left ramus, not fewer than six accessory ridges in the flattened and rather depressed tract included between the hinder terminal ridges or angles of the outer and inner convex ends of the hind lobe. Of these six vertical ridges two are larger than the rest, and of the narrow pyramidal shape before mentioned (they answer to those marked *h* in fig. 10, Plate LXXIX.).

In the unworn molar of this young jaw (Plate LXXX. fig. 6, m_1) the mid link does not come to the grinding-surface as in the worn molars from the mandible of the adult *Procoptodon* (ib. fig. 4); they show a sharp concave border slightly notched midway. Notwithstanding some minor differences to be expected in the modifications of the enamel which complicate the crown of the molars in the present genus, the dimensions of d_4, m_1, m_2, and m_3 led me to view this mandible as having been derived from a young of *Procoptodon Goliah*.

The germ of the premolar was accordingly sought for, and the right ramus (Plate LXXX. fig. 7) was fortunately so far preserved as to include its formative cell *. The crown of the tooth therein lodged (ib. fig. 3) has a fore-and-aft extent one third greater than the larger of the two teeth (d_3) which it displaces; the outer side of the crown is divided, as in *Procoptodon Rapha*, by a vertical groove, but more equally; a short second vertical groove or notch indents the hinder division, near the main groove. The convexity of the exposed part of the crown testifies to the procoptodont character of this premolar.

The incisors, both broken away near their issue from the alveoli, show a full elliptic section, 6 lines in the vertical, 5 lines in the transverse direction; they come almost into contact medially; the transverse extent of the pair is 10 lines; their direction is obliquely forward and upward, as in *Nototherium*, not procumbent as in the typical *Macropodidæ*.

The symphysis is continued, broadly, to the incisive outlets; it has insured, apparently, an attachment to each other of the rami of this instructive mandible, too intimate to be disturbed by posthumous movements, although anchylosis had not been completed, if it had commenced. From the anterior molar to the incisor measures but 10 lines, though it might be 1 inch or a little more if the incisive alveoli were entire. The outlet of the dental canal (ib. fig. 6, *v*) is small; it is 3 lines below the diastemal border, and 5 lines from the fore part of the socket of d_2.

Each ramus is thick vertically, convex externally, in a degree increasing to the origin of the coronoid plate. The thick lower border, where it curves from the horizontal to the ascending parts of the ramus, is slightly inflected; a rather wide shallow groove extends above it. The inner surface of the ramus in advance of the inflection is feebly convex vertically. The base of the coronoid process describes a curve convex inward as it extends from before backward.

The lower border of the left ramus is entire from below (m_1) backward to the hind fracture; it is obtuse. The thickness or transverse diameter of the ramus, below the middle of m_3, is rather more than four fifths the vertical diameter at that part. Thus the characters of the mandible of the smaller species of *Procoptodon* are closely repeated in that of the immature specimen of the larger species.

If the present mandible of *Procoptodon Goliah* be compared with that of *Nototherium Mitchelli* in a like state of preservation, which is the subject of Plate IV. Philosophical

* Permission to remove the requisite portion of bone was accorded by the Museum Committee of the Royal College of Surgeons.

Transactions, 1872, or if a reference be made to that Plate and Plate VIII. (op. cit. *Nototherium inerme*), the interesting and instructive modification of the present extinct Marsupial, as transitional between *Macropus* and *Nototherium*, will be obvious. But the true macropodal character comes strongly out in the different result of the quest in the substance of the jaw carried out in the subject of fig. 7, Plate LXXX. of the present memoir, and in fig. 5, Plate VI. (*loc. cit.*) of a *Nototherium* at a similar stage of immaturity.

I have been favoured with a photograph of a portion of a left mandibular ramus of a young *Procoptodon Goliah* at a corresponding stage of dentition (Plate LXXX. fig. 5). This was obtained from the Breccia-cave of Wellington Valley; the original is in the Museum of Natural History of Sydney, New South Wales.

§ 9. Genus *Palorchestes**, Ow.—The finest fossil evidence which has yet reached me of an extinct Kangaroo is the portion of skull figured, of the natural size, in Plates LXXXI., LXXXII., & LXXXIII.

It was discovered in the year 1851 by Dr. LUDWIG BECKER, "in a bed of yellowish sand and clay mixed with very small shells," in the Province of Victoria, Australia. The matrix had been cleared off before the fossil reached me.

I am indebted for the opportunity of now describing and figuring this specimen to the kindness and liberality of my esteemed friend and fellow labourer in palæontology, the late estimable Dr. KAUP, of Darmstadt, to whom the fossil was in the first instance transmitted.

It is much petrified, heavy, massive, like most of the fossils from the freshwater formations of Australia; but it partakes of the colour of its matrix, which is lighter than that of the fossils from the drift-beds of Queensland.

It includes the facial or fore part of the skull with the bony palate and both right and left series of molars. The sockets of the three incisors are preserved in the right premaxillary (Plate LXXXII. fig. 1, i 1, 2, 3); the left has suffered fracture in that part.

Comparing the least-worn molar in this skull (Plate LXXXII. fig. 1, m 2, and fig. 2, restored) with the corresponding tooth in the upper jaw of *Procoptodon* (Plate LXXIX. fig. 1, m 2), the coronal enamel is disposed on a simpler pattern, more in accordance with that of the normal Kangaroos†. Moreover, as in the larger living and extinct species of *Macropus*, the bony palate is entire (Plate LXXXII. fig. 1).

The usual permanent or adult series of five molars have remained in place and use in our present fossil, whereas at the degree of wear shown by the last grinder, the first, if not also the second, would have been shed in *Macropus* proper‡.

In the maintenance of the adult series of five grinders the fossil resembles *Osphranter*, *Halmaturus*, and *Sthenurus*, but the premolar (ib. ib. p 3) differs in shape and proportion. Its antero-posterior extent is but three fourths that of the next tooth (ib. d 4); in *Osphranter* and *Petrogale* (Plate LXXVII. fig. 1) the premolar equals, in *Halmaturus*

* παλαιὸς, ancient; ὀρχηστὴς, leaper.

† Philosophical Transactions, 1874, Plate XXI. fig. 10, m 2 (*Macropus Titan*).

‡ Ib. ib. fig. 15 (*Macropus Titan*).

and *Sthenurus* it exceeds, d_4 in that dimension. But in the fossil the transverse diameter of the premolar in proportion to the length of the crown is greater than in any known existing Kangaroo, and in this respect is equalled only by the extinct Procoptodons. As in these, also, the front pier of the zygoma (ib. 21″) has a more advanced position in relation to the molar series than in *Macropus*, *Osphranter*, or *Halmaturus*. But the chief distinctive character of the present fossil is the great proportional length of the premaxillaries (Plates LXXXI.–LXXXIII. 22, 22′) and the concomitant backward position of the incisive or premaxillary palatine foramina (ib. *a*), which are closer together, and were separated by narrower processes of these bones, if so separated at all; for the foramina in the fossil seem to have been confluent, and were certainly short and parallel; whereas in *Macropus*, *Osphranter*, *Halmaturus*, and *Petrogale* (Plate LXXVII. fig. 1, *a a*) they are relatively longer, are wider apart, and usually with their narrow or pointed hind ends convergent.

The dental formula, $i\,\frac{3\text{-}3}{}$, $c\,\frac{0}{}$, $m\,\frac{5\text{-}5}{}$, and pattern of the grinding-surface of the molars (Plate LXXXII. fig. 2) being macropodal, the differential characters from known recent and fossil Kangaroos are of subgeneric value, and call for the usual taxonomic indication which heads the present section.

§ 10. *Palorchestes Azael*, Ow.—The fore end of the premaxillaries is not quite entire, but sufficient of the sockets of the three incisors of the right side remain to show that not more than half an inch of the bone can there be wanting; the teeth have dropped out prior to fossilization. From the fore end of the skull to the premolar (p_3) is 5 inches; the length of the molar series is 4 inches 6 lines. These two admeasurements are relatively almost the same in *Osphranter robustus*, the length of its series of five molars being 2 inches 2 lines, and that of the skull in advance of the premolar being 2 inches 3 lines; the part of the skull behind the last molar in the fossil is 2 inches 9 lines in length. On this basis the entire skull of *Palorchestes Azael* may be reckoned at about 16 inches in length.

The extent of the diastema in the upper jaw supports an inference of a like extent in the lower, and would show a nearer resemblance, in the latter respect, of *Palorchestes* to *Macropus*, *Osphranter*, and other genera of normal Kangaroos, than to the extinct *Sthenuri*, *Protemnodons*, and *Procoptodons*, which, in their shorter and deeper diastemal and symphysial part of the mandible, exemplify the transition to *Nototherium*.

The extent of the premaxillaries (22) from the alveolar outlets to the anterior bony nostril (*n*) is relatively greater than in any skull of a living Kangaroo I have yet seen (compare fig. 2 with fig. 3, Plate LXXXI.). The tract in question slopes backward as it rises and curves, more vertically near the nostril, where it swells into a pair of low tuberosities (ib. fig. 1, *n*). So far the union of the two premaxillaries is close, seemingly anchylosed, though the mid line of their symphysis is traceable. In this character *Palorchestes* offers a resemblance to the Koala and Wombat*. A little behind the tuberosities each premaxillary sends upward its plate to form the outer walls of the

* Philosophical Transactions, 1872, Plate II. figs. 3 & 4.

nostril. The fore or free edge of this plate is thick, rounded, and slopes backward as it rises in a greater degree than the subnasal coalesced plate.

Of the right side-plate but an inch and a half is preserved; the left one (ib. ib. $_{22'}$) is continued to its junction with the maxillary ($_{21'}$); and this extends backward to near the orbit, $7\frac{1}{2}$ inches from the incisive alveoli. The upper border of this plate is, at first, thinner than the anterior or ascending border, but gains in thickness as it approaches the orbit (Plate LXXXIII. fig. 1, $_{21'}$); it may have been broken and the fractured margin worn smooth and obtuse; as it is, it shows no trace of the junction with the nasal bone. As much of the plate as remains is nearly vertical, neither swelling outward, as in *Macropus major* and *Osphranter*, nor bending inward at its upper part to join the nasal, as in all recent Kangaroos. The external nostril must have been relatively narrower, and seems to have been longer and more upward in aspect than in other known *Macropodidæ*.

The floor of the nostril is continued backward by the coalesced premaxillaries 2 inches behind the lower border of the aperture (Plate LXXXIII. fig. 1, *n*); it is here half an inch in breadth, concave and pitted along the line of the interpremaxillary suture. Then, seemingly, it has been broken off, the thinner vertical plates rising from the partition of the confluent prepalatine openings (ib. *a*), which are seen at a lower level. Behind these the bony base of the "septum narium" rises for about half an inch before its fracture; and it can be traced back three inches (as at *n*) before it suddenly sinks down to the lower level of the upper surface of the bony palate (ib. *b b*). This subsidence is more abrupt than in living Kangaroos (ib. fig. 2, *b b*), and each lateral division of the superpalatal part of the floor of the nasal chamber forms, anteriorly, in *Palorchestes* a blind fossa (ib. fig. 1, *b b*) below the level of the floor of the antorbital part (ib. *n'*) of that chamber.

Some traces are discernible of the suture between the premaxillary and maxillary upon the palate (Plate LXXXII. fig. 1, $_{21'}$) and upon the side of the facial part of the skull. Behind the third incisive alveolus, on the right side, a narrow oblique cavity like an alveolus (Plate LXXXI. fig. 1, *c*) is exposed by fracture or attrition of the outer palate of the premaxillary, into the base of which cavity opens a small vascular or nervo-vascular canal; this may have contained the germ or aborted rudiment of a canine.

The bony palate (Plate LXXXII. fig. 1) loses a little breadth behind the incisive foramen (*a*), then expands with an outward curve to the sockets of the premolars (p 3). A mid tract of the breadth of the incisive foramen is continued backward as a very shallow channel to opposite the third grinder (m 1), where the uniform level of the bony palate is gained. A similar but rather deeper channel is continued forward from the fore part of the incisive foramen, and slightly expands to its termination at the outlets of the mid incisors (i 1). The intermolar tract of the bony palate is less concave longitudinally than in *Macropus* and *Osphranter*, and less so transversely than in *Maropus major*. *Osphranter* more resembles *Palorchestes* in this direction.

There is no trace in *Palorchestes* of the pair of small oblong holes where the palato-maxillary suture (ib. ib. $_{20}$) begins to bend backward near the socket of the last molar.

In *Palorchestes* this suture describes a less angular, more semicircular course than in existing Kangaroos. The hind border of the bony palate appears to have been more concave than in *Macropus major* or *Osphranter robustus*, in which respect it resembles more some of the *Halmaturi*. A pair of small vascular foramina, 1 inch 3 lines apart, occur at the interval between the right and left premolar (p^3).

The anterior pier of the zygoma (Plates LXXXII., LXXXIII., $^{21''}$) is subtrihedal, the hind surface or side being the broadest, nearly flat vertically, concave transversely. The fore part is subequally divided into an upper and lower facet by a forwardly directed rounded angle. A narrow semicircular notch (Plate LXXXI. fig. 1, *o*) at the upper part of the base of this pier indicates a part of an orbit relatively smaller than in the Kangaroos. Above and in advance of this notch is the ectorbital aperture of the lacrymal canal characteristic of the Marsupialia. There does not appear to be, in either side of the skull, a trace of an antorbital foramen; but I incline to believe in some accidental obliteration of that issue, rather than that it never existed.

Each molar series describes a slight curve convex outward. The base of the broken crown of the premolar is subelliptic (Plate LXXXII, fig. 1, p^3), $7\frac{1}{2}$ lines in long diameter, 6 lines in transverse diameter, which is at its middle; it is not broadest behind as in most other Kangaroos; the inner side is more convex than the outer one. The second molar (ib. ib. d^4) is bilophodont, with a prebasal ridge; a fold of enamel (ib. *f*) indicative of the ridge remains on the inner side; the rest of the ridge is lost in the continuous hollow tract of dentine occupying the base of the worn-down anterior lobe (*a*). Opposite folds of enamel, the inner one the longer, indicate the interlobal valley; the dentine at the base of the link (*r*) leads across from the anterior to the posterior field of attrition. The third molar (ib. ib. m^1) has been worn down to the same degree. In both these molars the inner side of the basal part of the front lobe (*a*) encroaches further than that of the hind lobe (*b*) upon the bony palate, forming the origin of a very strong antero-internal root. In the fourth molar (m^2) and in the last (m^3), the corresponding root makes a projection beyond the inner side of the hind lobe of the tooth in advance. The base of the mid link (*r*) remains in m^2; in m^3 that link shows a median notch. More of the narrow prebasal ridge (*f*) is apparent in the last two teeth. The hind surface of the penultimate and last molars seems to have been slightly depressed at *g*, fig. 2, but much less so than in *Macropus major* and *Osphranter robustus*; the hind lobe of m^3 is narrower than that of m^2. The greatest breadth of the crown of the third molar (m^1) is 10 lines. The surface of the enamel in all the grinders appears to be finely rugous.

Thus, so much of the dental characters as can be defined in the present unique fossil concurs with the cranial ones in showing *Palorchestes Azael* to have deviated less from the type of the existing bilophodont *Macropodidæ* than have the species of *Procoptodon*, some of which (*Proc. Goliah*, for example) were its rivals in bulk.

Description of the Plates.

PLATE LXXVI.

Fig. 1. Upper view of portion of right mandibular ramus, with the hindmost molar, of *Macropus Titan.*
Fig. 2. Upper view of an aged individual of *Macropus Titan.*
Fig. 3. Upper view of portion of left mandibular ramus, with the hindmost molar and débris of antecedent ones, of an aged *Macropus Titan.*
Fig. 4. Outside view of figure 2.
Fig. 5. Inner side view of figure 3.
Fig. 6. Outer side view of the teeth in ditto; 6*a*, hind surface of much-worn last molar of *Macropus Titan.*
Fig. 7. Outside view of portion of right ramus, with three hindmost molars, of *Pachysiagon Otuel*, Ow.
Fig. 8. Inside view of the same fossil.
Fig. 9. Upper view of the same fossil.
Fig. 10. Hind view of the same fossil.
Fig. 11. Outside view of part of right mandibular ramus, with the penultimate and antepenultimate molars, of *Leptosiagon gracilis*, Ow.
Fig. 12. Inner view of the same fossil.
Fig. 13. Upper view of the same fossil.
Fig. 14. Hind view of the same fossil.
Fig. 15. Section of middle of mandibular ramus of the same fossil.

PLATE LXXVII.

Fig. 1. Under view of cranium of *Halmaturus brachyurus*, Wth.
Fig. 2. Outside view of part of the upper jaw and teeth of *Procoptodon Pusio*, Ow.
Fig. 3. Inside view of the same fossil.
Fig. 4. Front view of the same fossil.
Fig. 5. Back view of the same fossil.
Fig. 6. Under view of right and left maxillæ of the same young *Procoptodon Pusio.*
Fig. 7. Left upper molar series of adult *Procoptodon Pusio.*
Fig. 8. Outer side view of fore part of left mandibular ramus, with the premolar exposed, of *Procoptodon Rapha*, Ow.
Fig. 9. Inner side view of the same fossil.
Fig. 10. Back view of the same fossil, showing relation of the premolar (p 3) to the milk-molar, d 3.
Fig. 11. Upper view of the same fossil: *a*, section of incisor.
Fig. 12. Under view of the same fossil.

PLATE LXXVIII.

Fig. 1. Outside view of right mandibular ramus of adult *Procoptodon Rapha.*
Fig. 2. Inside view of the same fossil.
Fig. 3. Upper view of the same fossil.

PLATE LXXIX.

Fig. 1. Portion of upper jaw and hinder molars of *Procoptodon Goliah.*
Fig. 2. Outer side view of left maxillary and teeth of an old *Procoptodon Goliah.*
Fig. 3. Inner side view of the same fossil.
Fig. 4. Under view of the same fossil.
Fig. 5. Outer side view of a portion of left maxillary and teeth of a less aged *Procoptodon Goliah.*
Fig. 6. Inner side view of the same fossil.
Fig. 7. Working-surface of the grinders of the same fossil.
Fig. 8. Upper view of hind part of left mandibular ramus, with two hind molars (m_2, m_3), of *Procoptodon Goliah.*
Fig. 9. Hind view of last upper molar of *Procoptodon Goliah.*
Fig. 10. Hind view of last lower molar, ditto.
Fig. 11. Outer side view of adult series of grinders, right side, lower jaw, of *Procoptodon Goliah.*

PLATE LXXX.

Fig. 1. Inside view of part of right mandibular ramus of a mature *Procoptodon Goliah.*
Fig. 2. Grinding-surface of the teeth in the same fossil.
Fig. 3. Outside view of a fragment of the left mandibular ramus, with the penultimate molar, of a mature *Procoptodon Goliah.*
Fig. 4. Inside view of the same fragment, showing the last two grinders.
Fig. 5. Inside view of part of the right mandibular ramus of an immature *Procoptodon Goliah* (from a photograph).
Fig. 6. Outer side view of right mandibular ramus of an immature *Procoptodon Goliah.*
Fig. 7. Portion of the same ramus, with the premolar (p_3) exposed in its formative cell.
Fig. 8. Grinding-surface of worn penultimate lower molar of *Procoptodon Goliah.*

PLATE LXXXI.

Fig. 1. Right side view of fore part of the skull of *Palorchestes Azael*, Ow.
Fig. 2. Fore end of the same fossil.
Fig. 3. Fore end of the skull of *Osphranter robustus*, Gd.
Fig. 4. Inner side view of a fragment of the right mandibular ramus of *Macropus Ferragus*, Ow.

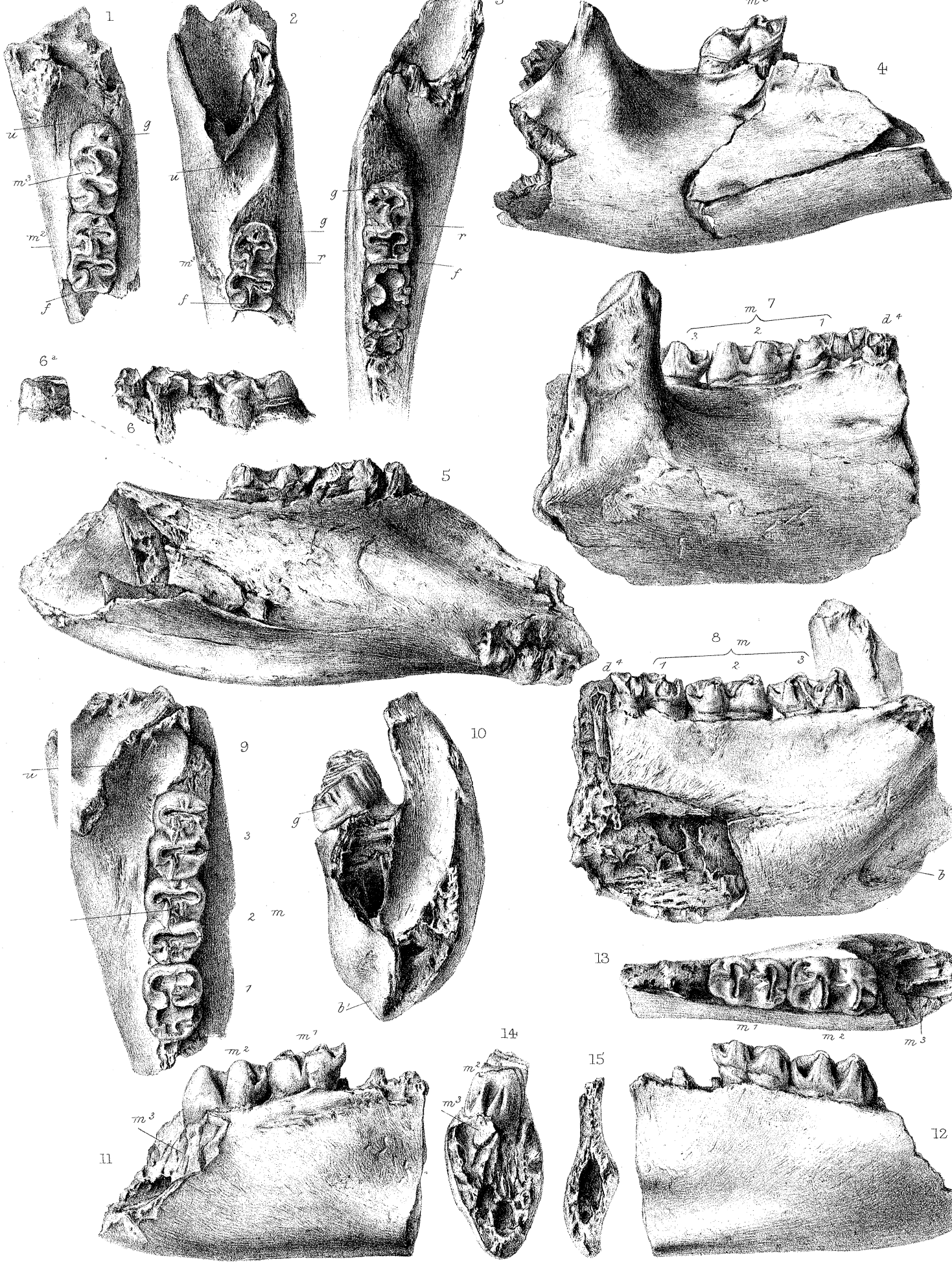
PLATE LXXXII.

Fig. 1. Under view of the fore part of the cranium of *Palorchestes Azael*, Ow.
Fig. 2. Pattern of working-surface of penultimate upper molar of ditto.
Fig. 3. Outer side view of portion of right mandibular ramus and last two molars of *Macropus Ferragus*, Ow.
Fig. 4. Upper view of the same fossil.

PLATE LXXXIII.

Fig. 1. Upper view of the fore part of the cranium of *Palorchestes Azael.*
Fig. 2. Upper view of corresponding part of the skull of *Macropus ruficollis*, Gd.
Fig. 3. Back view of mandibular fragment, with last grinder, of *Macropus Ferragus.*

All the figures are of the natural size.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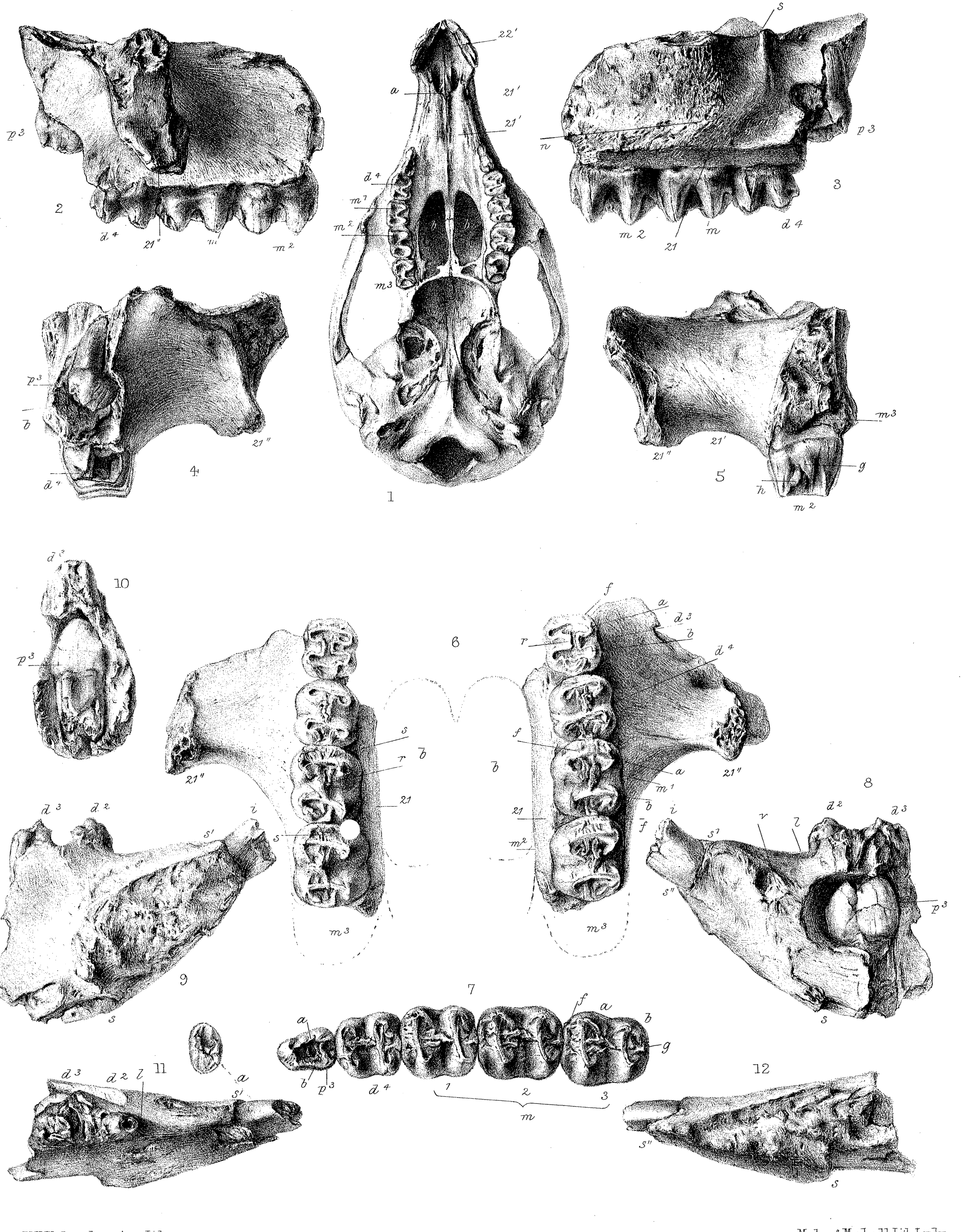
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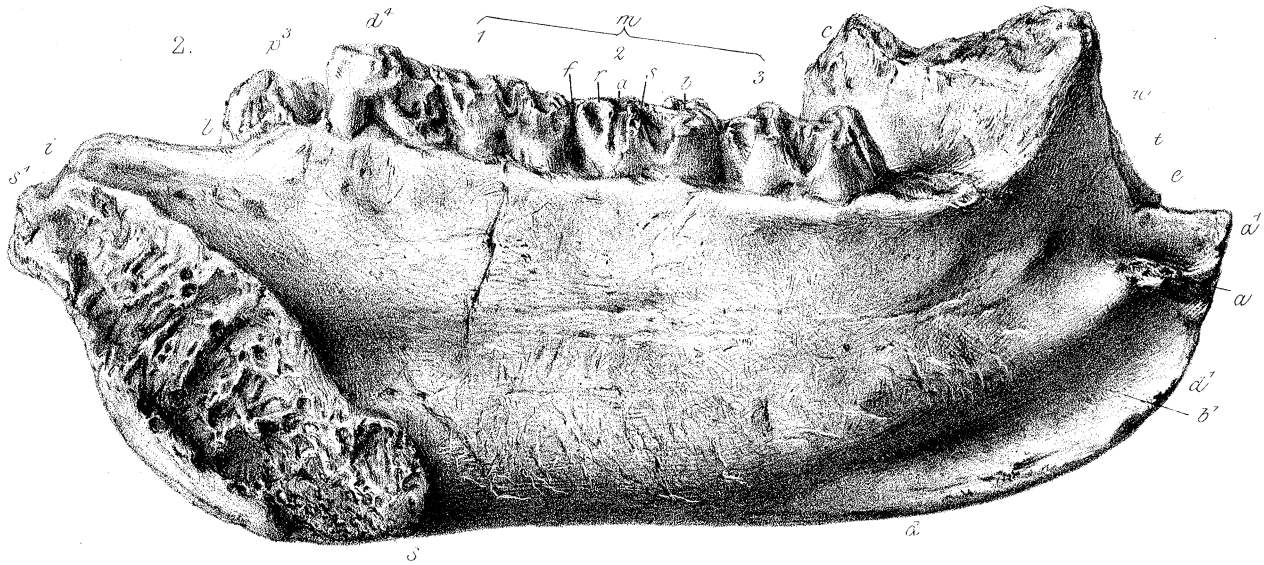
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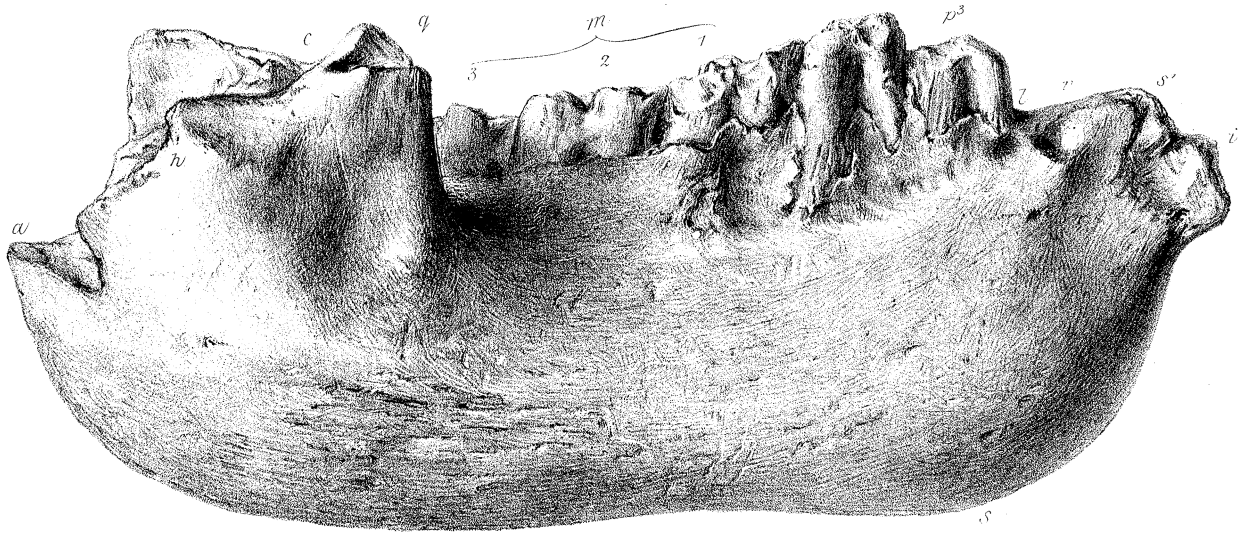
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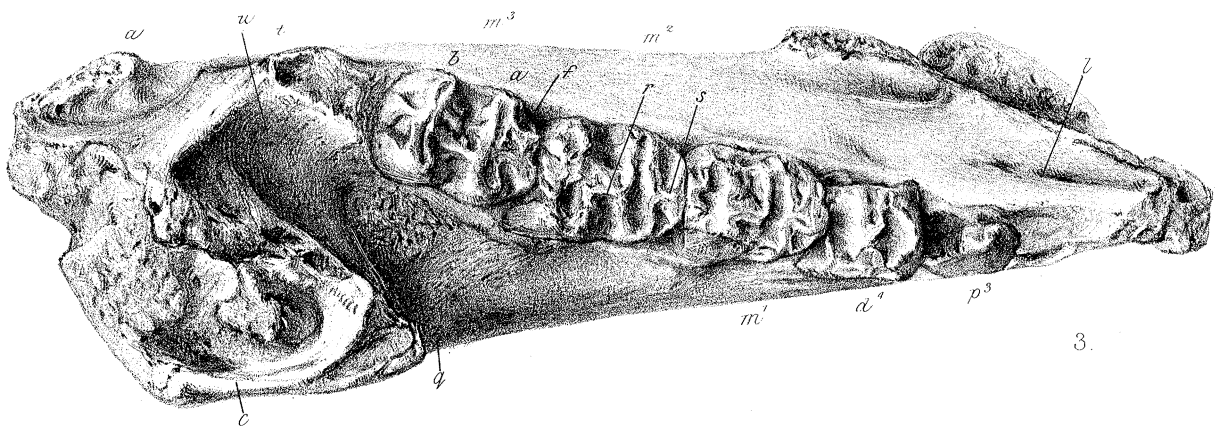
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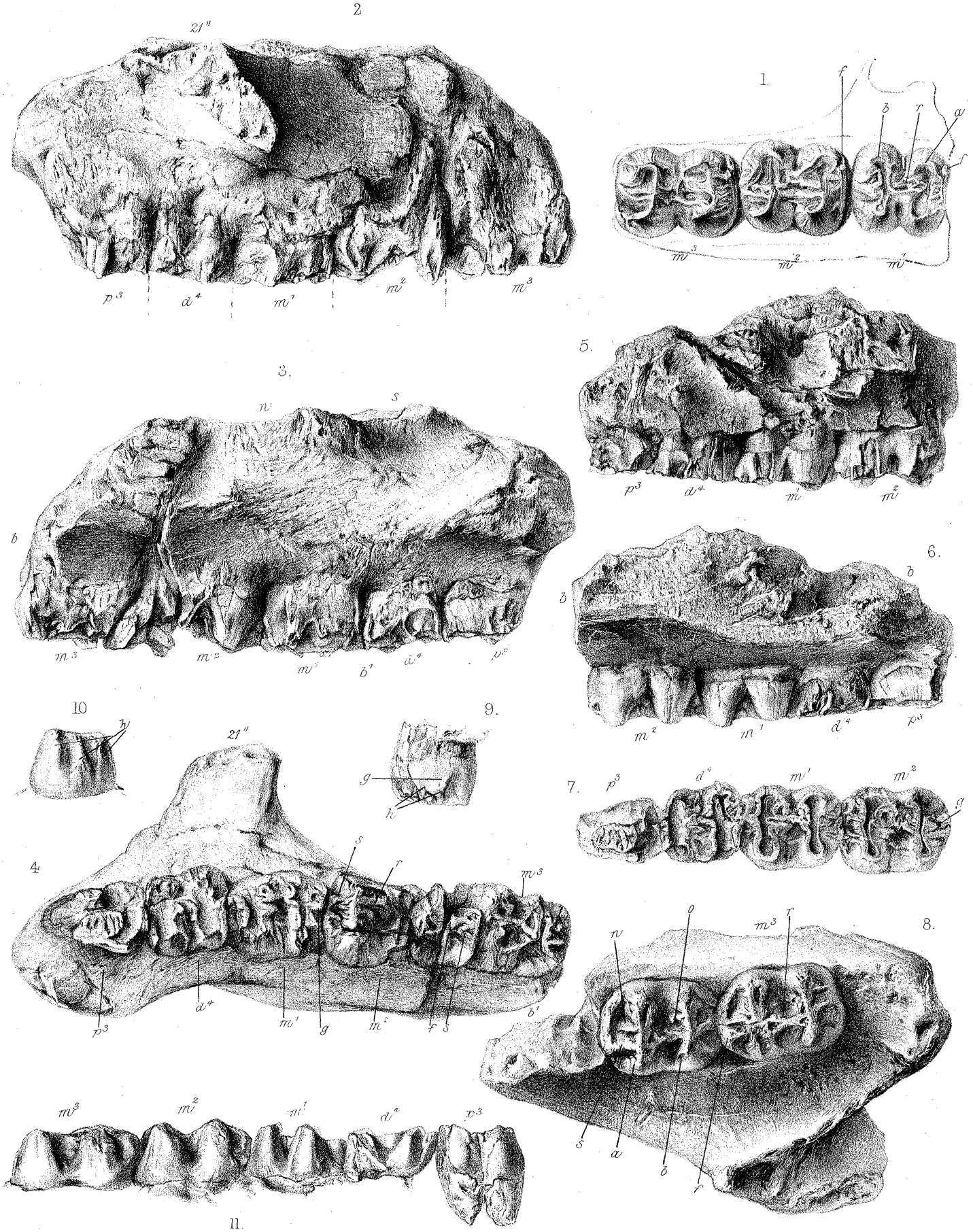
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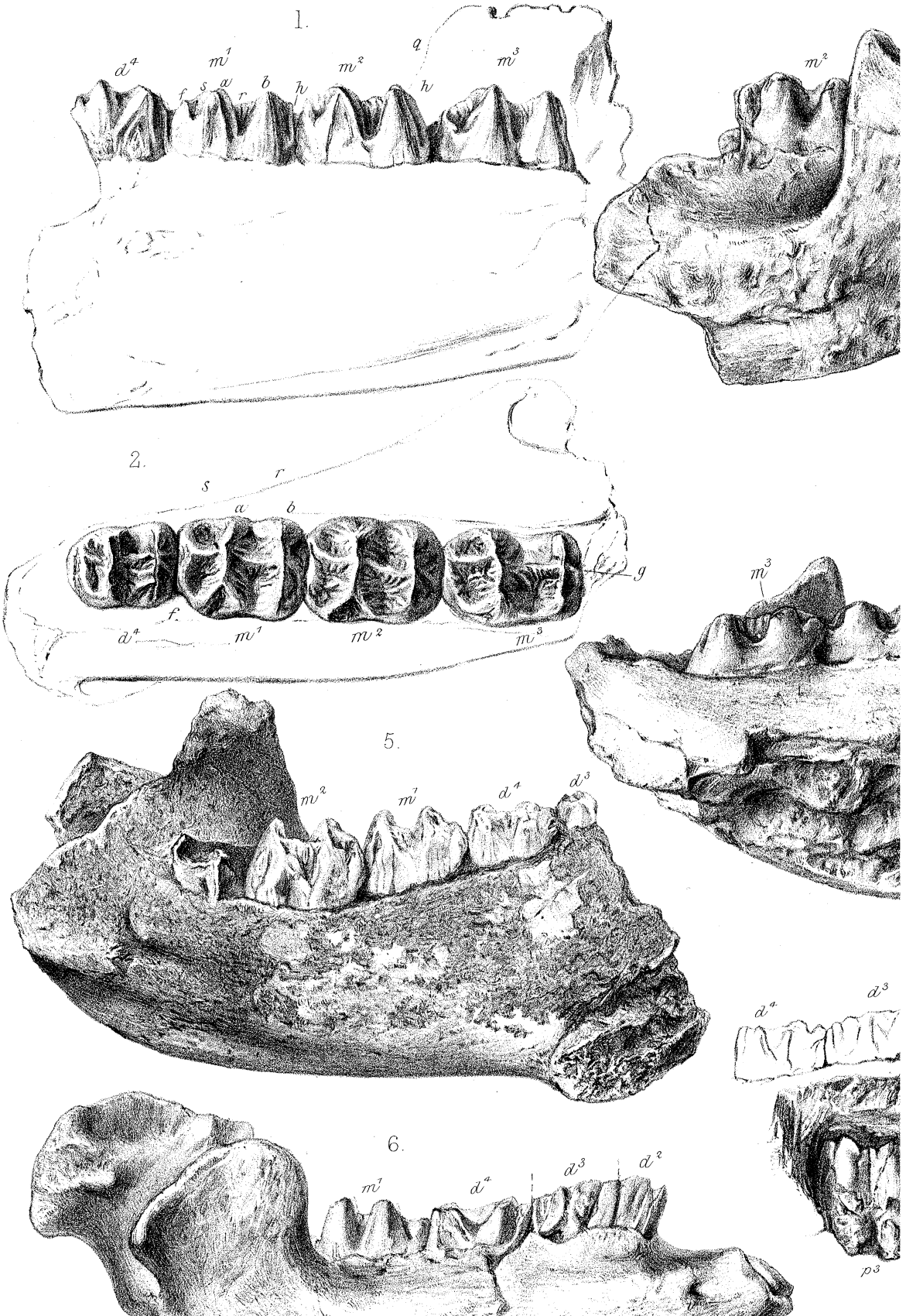
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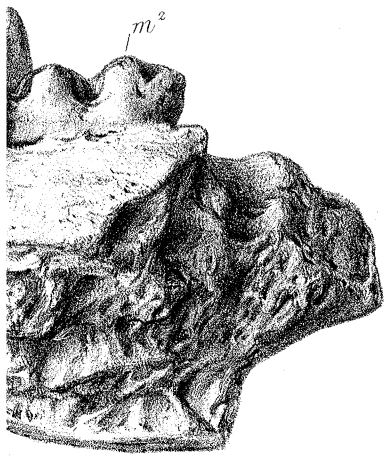

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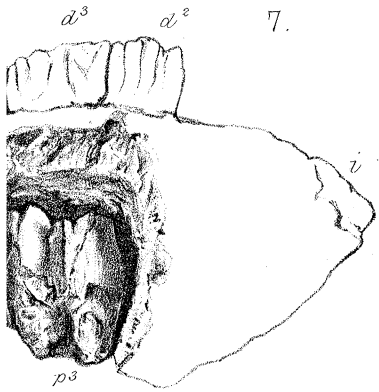

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W.H. Wesley, Auto. Lith.

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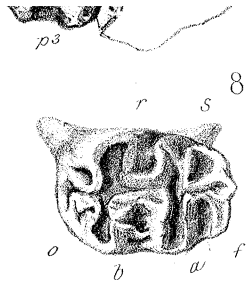

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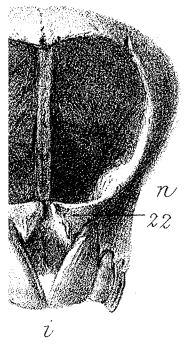

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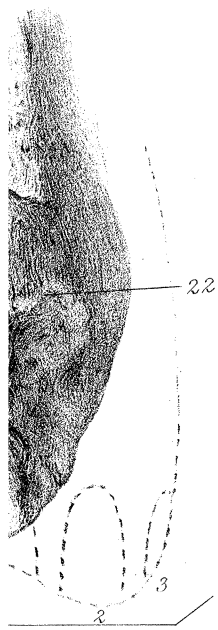

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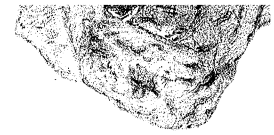
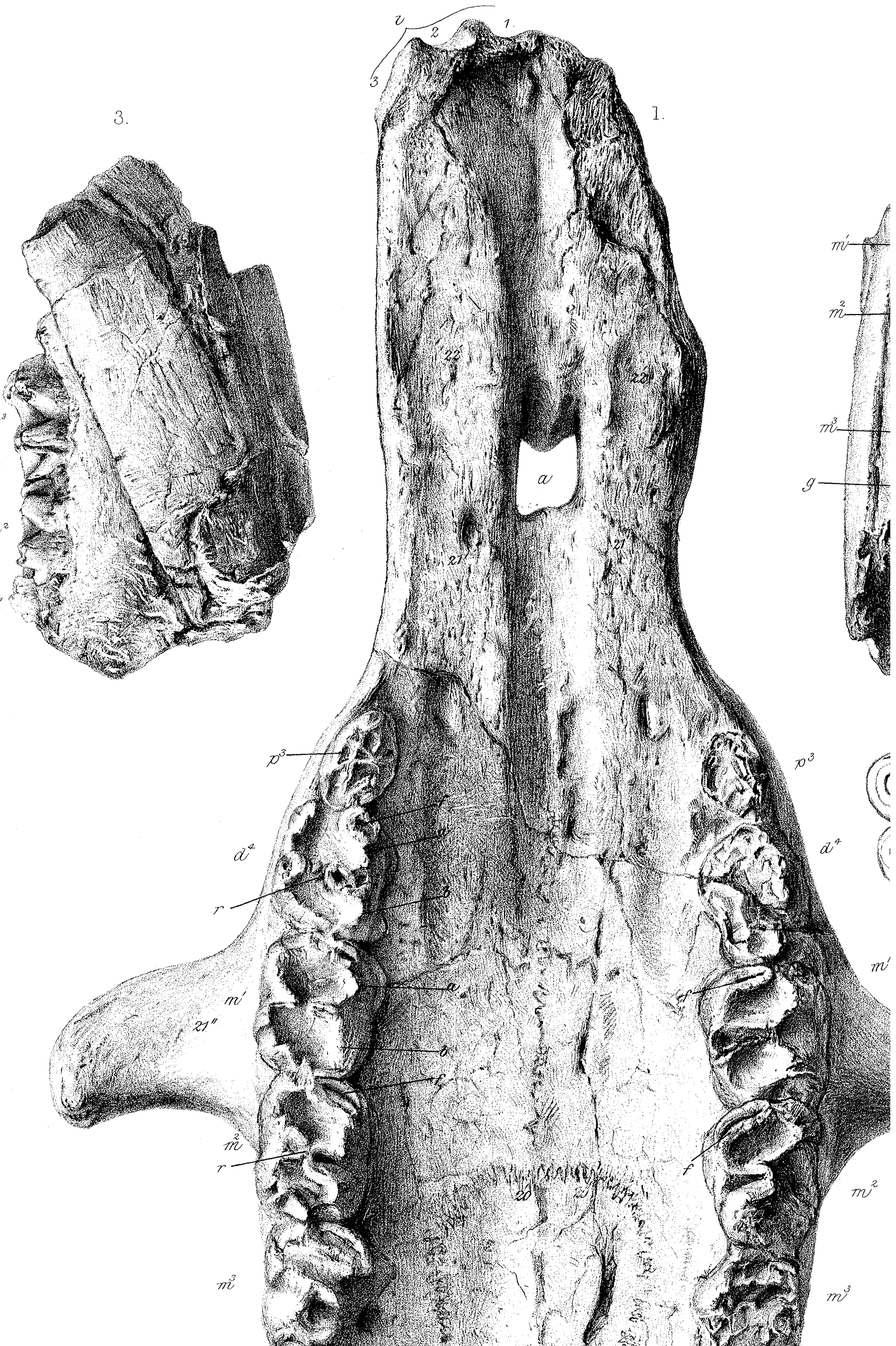


W.H. Wesley, Auto. Lith.

Maclure & Macdonald, Lith^rs London.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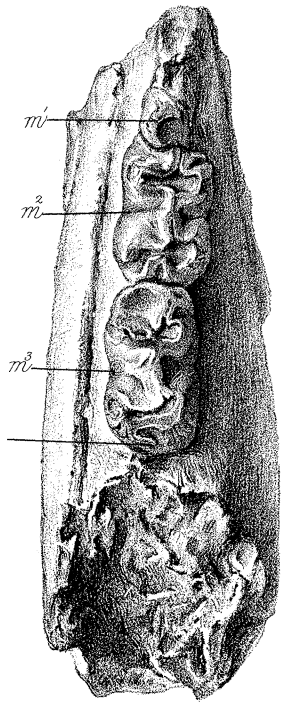

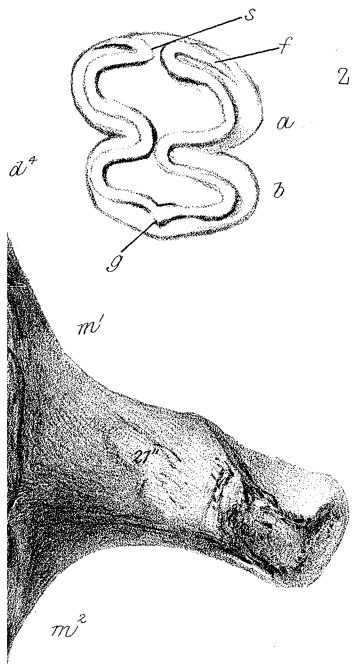

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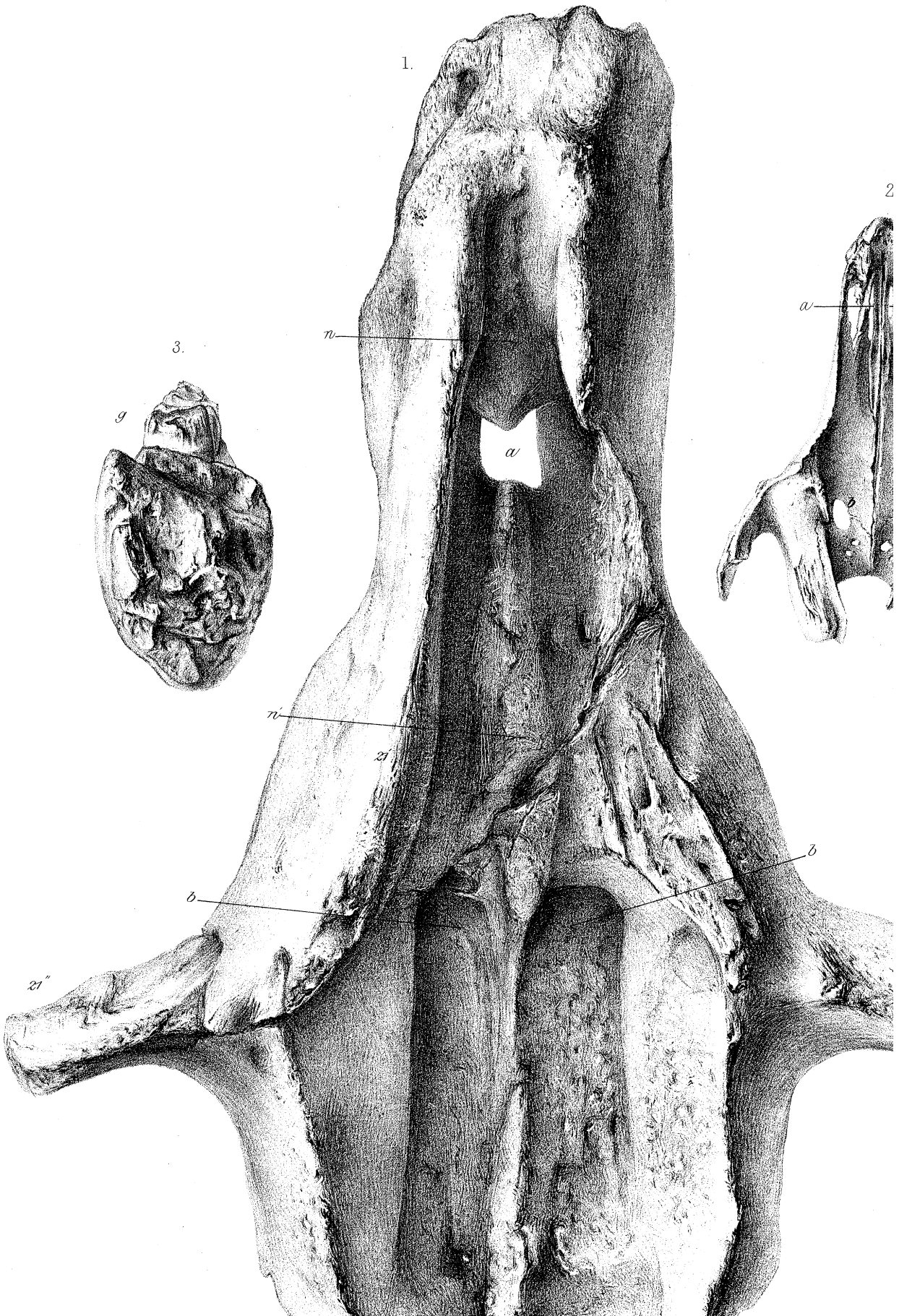
W.H. Wesley, ad nat. auto. lith.

Maclure & Macdonald, Lith. London.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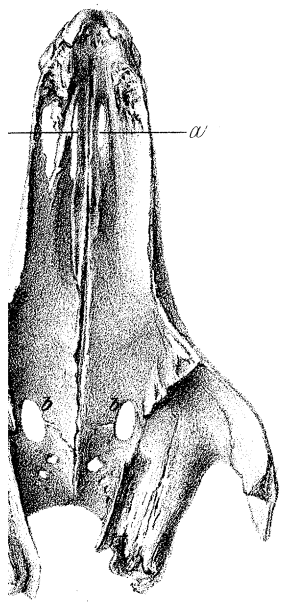

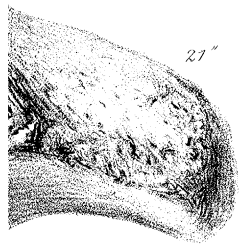

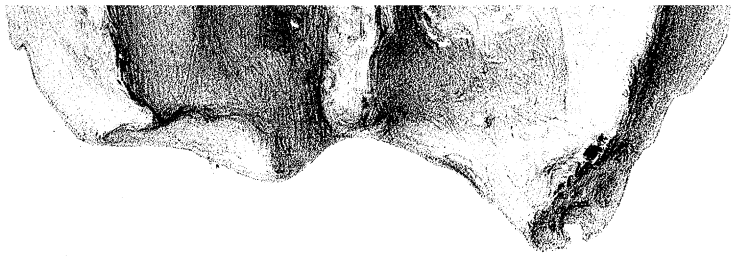

W.H. Wesley, ad. nat. auto. lith.

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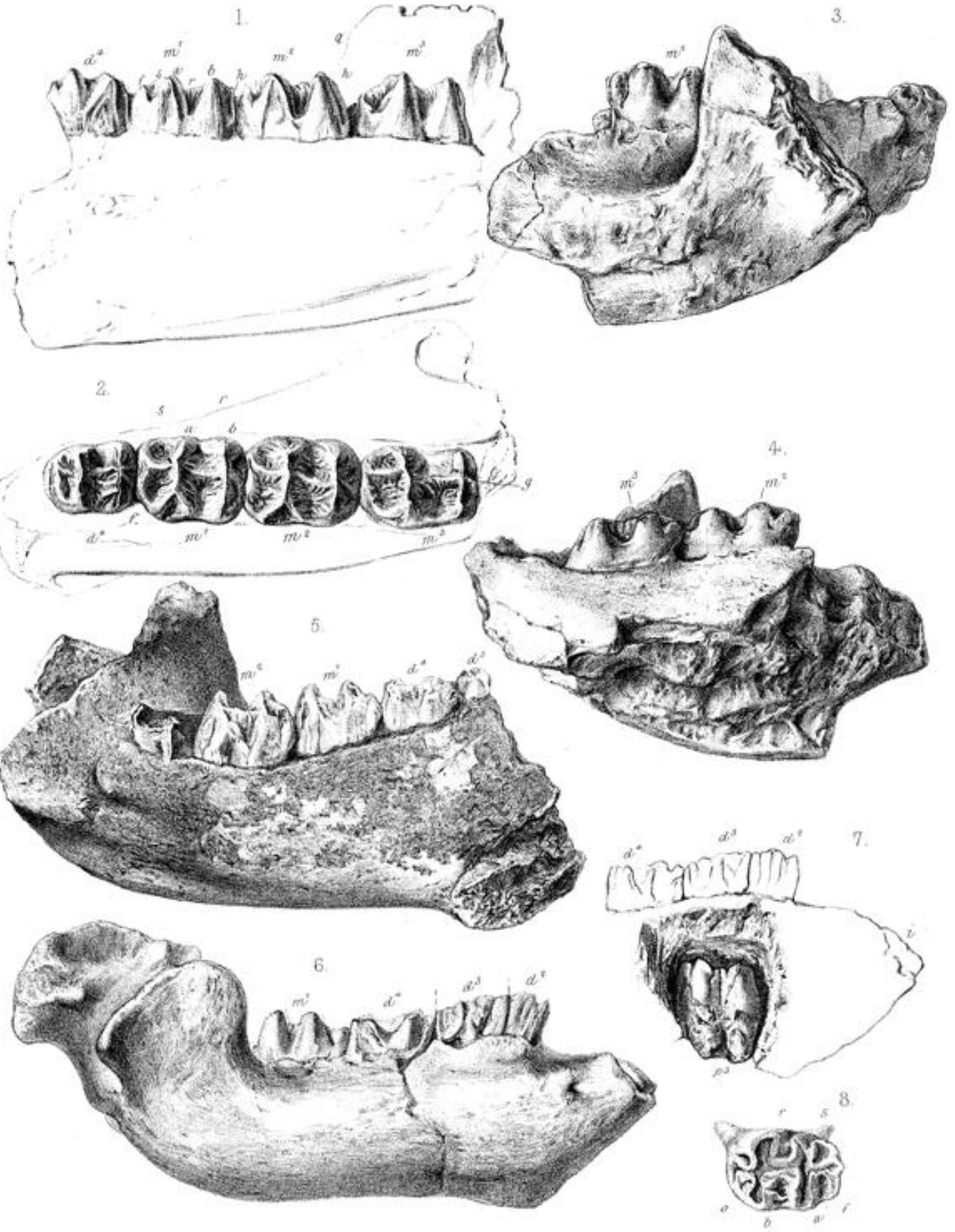
Maclure & Macdonald, Lith. London.



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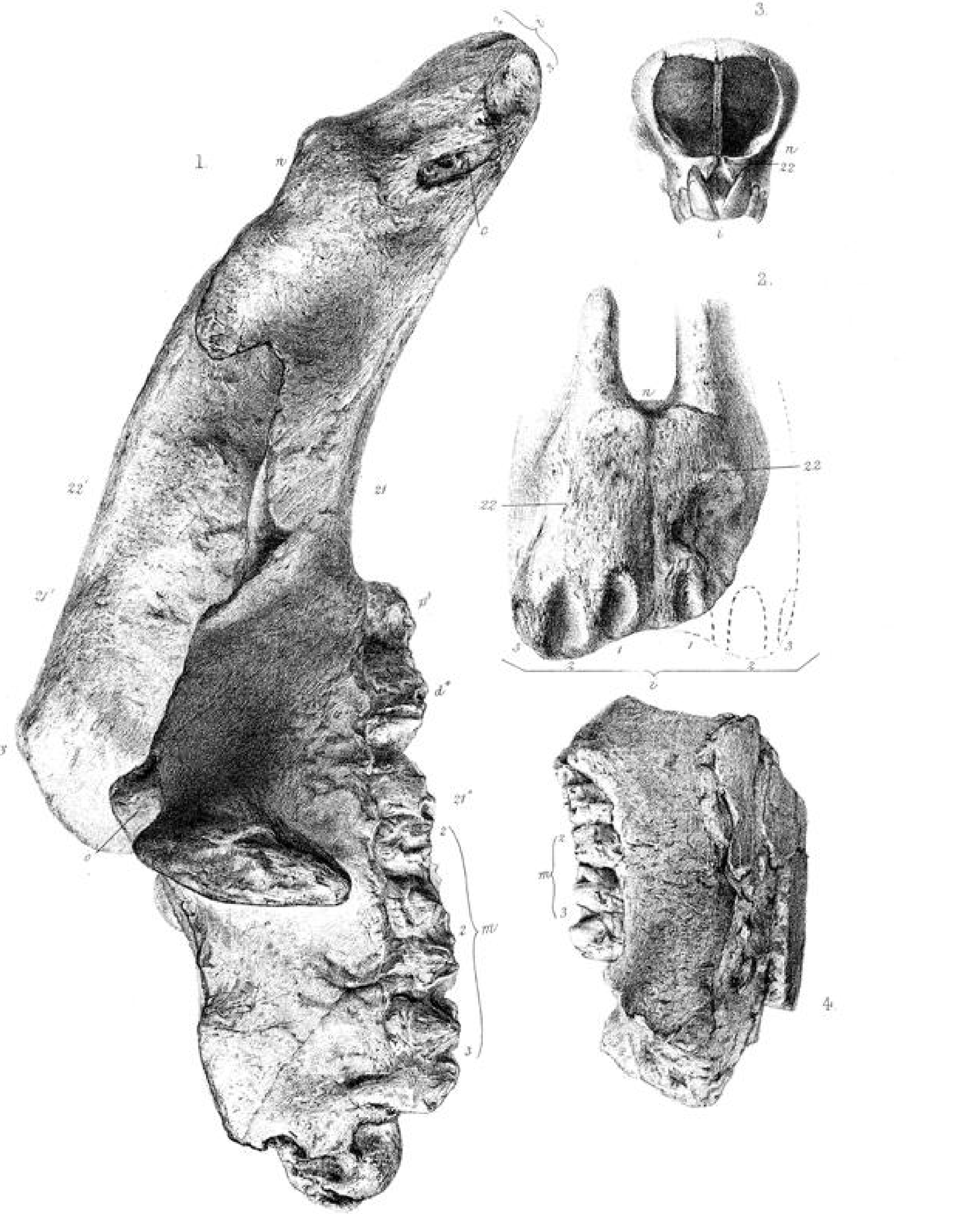
Mackrow & Macdonald, Lith^rs. London.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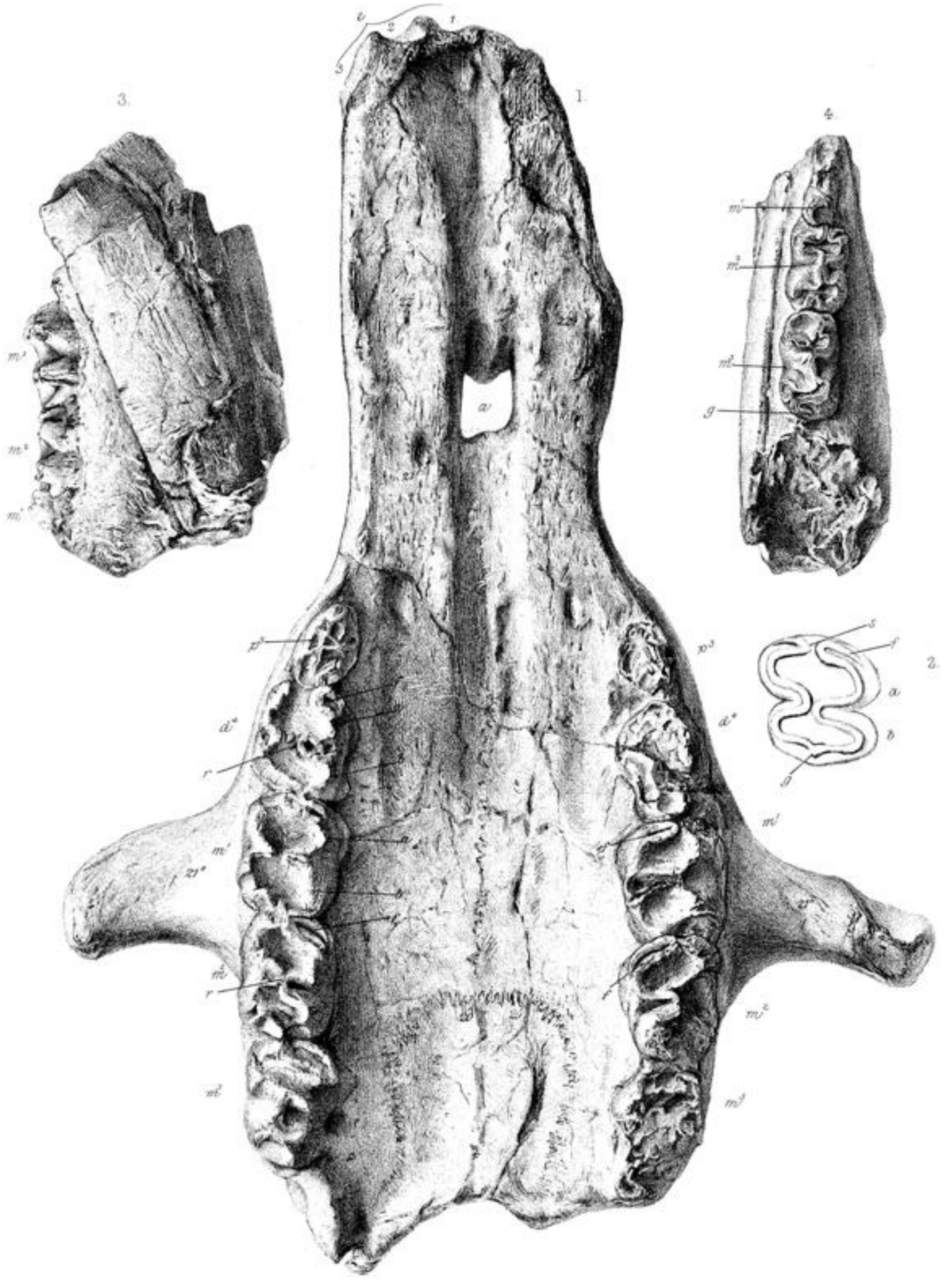
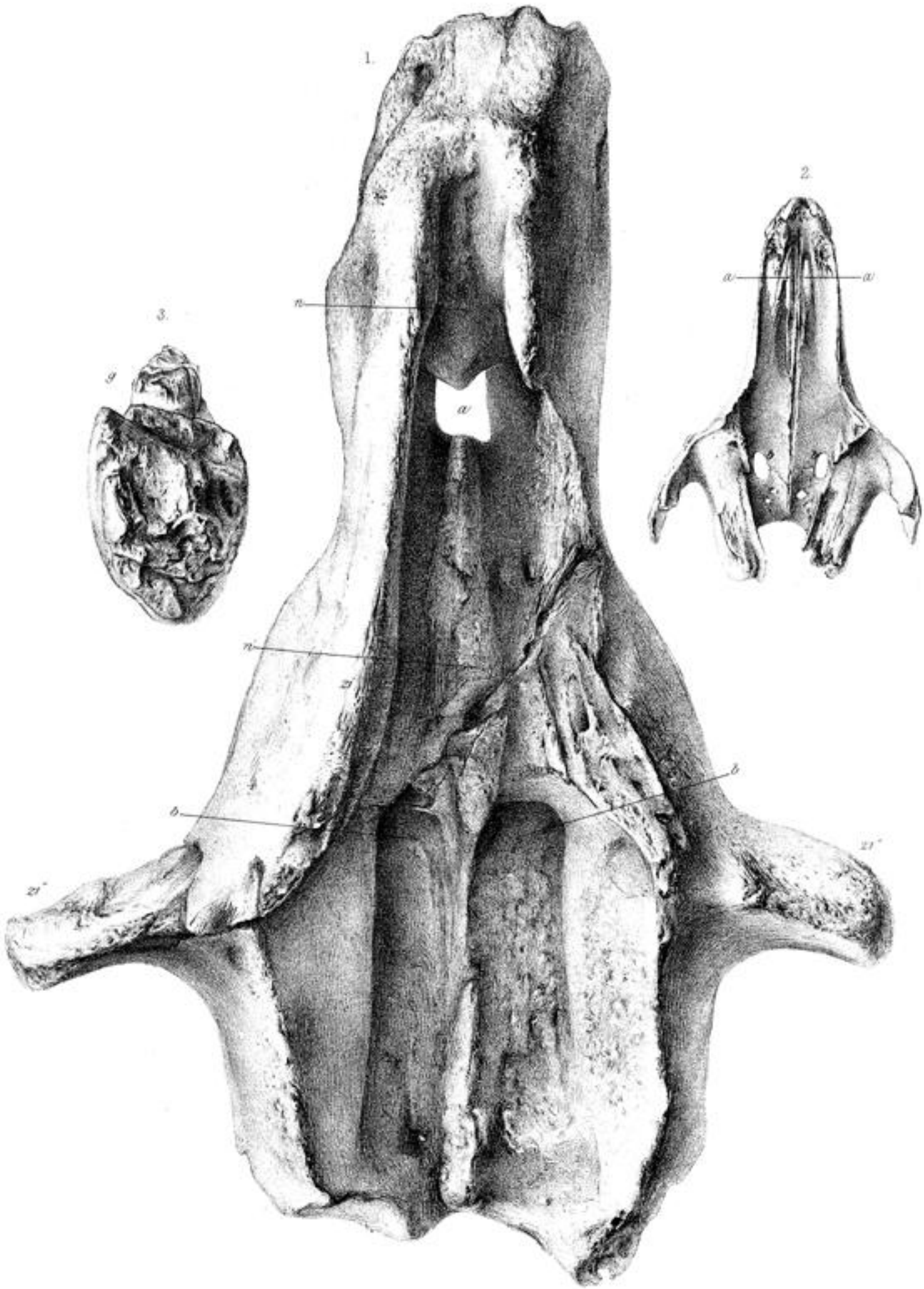


W.H. Worley, ad nat. sculp. Feb.

Madeley & Macdonald, Lith. London.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