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XIII. *Osteological Contributions to the Natural History of the Orang Utans (Simia, Erxleben).* By RICHARD OWEN, Esq., F.R.S., &c., Hunterian Professor of Anatomy at the Royal College of Surgeons.

Communicated October 25, 1836.

THE interest which is attached to the *Orang Utans*, their rarity and limited geographical distribution, and the obscurity which still envelopes the history of the species which appertain to the genus *Simia* as limited by Erxleben, induce me to offer to the Zoological Society some additional observations on that subject, which I hope may contribute to extend and establish our knowledge of those remarkable anthropoid inhabitants of the forests of the larger islands of the Indian Archipelago.

These observations relate only to the skull and teeth,—parts of the osseous system, however, which each day's experience seems to indicate as the principal points from which the best and surest specific as well as generic differences may be derived. The descriptions are accompanied with drawings of the objects described of the natural size. The *first* part of this paper describes an interesting stage in the change of the teeth in the great *Orang* of Borneo (*Simia Wurmbeii*); the *second* part relates to a skull of an *Orang* in which that change had been completed, but which retains proportions and presents a form apparently specifically distinct from those in any other known species.

Hitherto the proof of the immature state of the so-called *Simia Satyrus* has been derived from the discovery of the germs of large permanent teeth, hidden within the cavity of the jaw-bones¹. In the specimen now before the Society, (Pl. XXX., figg. 1, 2, 3.) some of the permanent teeth have come into use, and have displaced their puny predecessors.

¹ Since this paper was read, the *Livraison* of the *Monographies de Mammalogie* of M. Temminck, containing the important observations of its distinguished author on the rich collection of osteological and stuffed specimens of the *Simia Satyrus* in the celebrated Museum at Leyden, has been published. The wrapper of the *Livraison* bears date 1835, but reference is made in the text, (p. 122) to a letter received by M. Temminck, from Borneo, bearing date the 5th of October, 1836. It would have been unpardonable in me to have neglected the writings of so great an authority on the subject of the *Orangs*, had they been accessible at the time when the abstract of the present memoir was published in the Proceedings of the Zoological Society.

The following is a summary of the observations recorded by M. Temminck on the progress of dentition in the *Orang* of Borneo.

In an individual, 1 foot 5 inches high, all the deciduous teeth are in place; they correspond in number and kind with those of the human subject; but the molars of the lower jaw are larger; none of the permanent teeth are developed.

[1839]



My previous observations led to a knowledge only of the *size* of the permanent teeth, and opportunities like the present were wanting to gain an insight into the amount of deviation from, or resemblance to the human subject which the *Orang* presented in regard to the *order* of their development.

The skull of the *Orang* here described belonged to an individual measuring from the *vertex* to the heel two feet, eleven inches; its native habitat could not be ascertained with certainty, but I infer from the straightness of the contour of the skull between the orbits and intermaxillary bones, from the position of the *foramen magnum occipitale*, and the form of the *zygoma* and position of its suture, that this immature specimen must belong to the large species which inhabits the Island of Borneo (*Simia Wurmii*).

By comparing the side view of this skull with that given in Pl. 55, fig. 2., of the First Volume of the Society's Transactions, it will be seen that a considerable change has taken place in the antero-posterior extent of attachment of the temporal muscle; the mastoid ridge has, as it were, shifted its place, and retreated, by progressive absorption and deposition, nearer to the occipital plane of the skull. The size of the cranial cavity remains unchanged, but its *parietes* are thickened, especially at the line of the lambdoidal suture, preparatory to the development of the great ridge which is continued from that part in the adult; the zygomatic arches are also strengthened, and the superior maxillaries more produced, while the intermaxillaries, having given passage to the crowns of large permanent incisors, appear to have fallen in; the *rami* of the lower jaw are widened and deepened, and the horizontal portions lengthened in correspondence with the growth of the upper jaw. The permanent teeth in place in the upper jaw are the two middle or anterior incisors, and the first and second molars; the remaining teeth, viz., the lateral incisors, the *canines*, and the *molars*, which occupy the place of the future *bicuspides*, belong to the deciduous series.

In the lower jaw both the middle and lateral permanent incisors are in place, as also the first and second permanent *molars* on each side; the rest of the teeth consist of the deciduous *canines* and *molars*, corresponding to those of the upper jaw, together with one of the lateral incisors which has not yet been shed, but which retains only an insecure attachment in front of the corresponding permanent incisor.

In two other individuals a little more advanced in age, the two middle permanent incisors of the upper jaw have come into place, together with the first permanent molar. M. Temminck describes the second molar in these examples as having four tubercles (p. 130.); it is therefore deciduous, and would be replaced by the second *bicuspid*: the third molar which he describes, is the first of the permanent true *molars*.

In a female *Orang*, 2 feet, 4 inches, 6 lines high, the following permanent teeth are in place; the four lower incisors, the two middle upper incisors, the first and second true *molars*. The permanent teeth yet concealed are the lateral upper incisors, the *canines*, the *bicuspides*, and *dentes sapientie*.

In a male measuring 2 feet, 6 inches, 9 lines in height, probably younger than the preceding, the development of the permanent incisors is not so far advanced; the two middle ones of the upper jaw having scarcely penetrated the gum, the rest of the teeth are in the same condition.

In the human subject the permanent teeth come into place and use in the following order: the first true *molars* (between the sixth and eighth year); the middle lower incisors, the middle upper incisors, the lateral lower incisors, the lateral upper incisors, the *canines*, the *bicuspides*, (between the seventh and ninth years); the second true *molars* (about the twelfth); the third *molars* (twentieth to thirtieth year).

In the *Orang Utan* we see that the second true grinders are in place before the *canines*, or *bicuspides*, or even the lateral incisors of the upper jaw are shed; but as regards the incisors, there is the same priority in the development of those of the lower jaw as in the human subject. The difference in regard to the development of the *molars* indicates the greater importance of the large grinders to the young frugivorous *Orang*, as compared with the higher and more omnivorous animal.

It still remains to be determined in what order the *bicuspides*, last *molars*, and *canines* succeed each other. Judging from the state of advancement which they respectively exhibit, I should suppose that the huge *canines* would be the last to acquire their full development in the *Orang Utan*. The intermaxillary bones are still distinct from the maxillaries, and it is probable that the suture is not obliterated until the vascular activity in the neighbouring bone is excited by the passage into place of the permanent canine teeth.

The following differences may be observed between the deciduous teeth of the *Orang* and those of the human subject: the first or front incisors of the upper jaw are twice as large, and the fangs are proportionally flatter and broader; the lateral incisors very slightly exceed in size those of the human subject, but are directed more obliquely inwards or towards the middle incisors. The four lower incisors of the *Orang* are nearly twice the size of those of the human subject, and differ in the relative position of the lateral pair which converge more obliquely towards the middle pair. The *canines* are also nearly double the size of those of the human subject, and project beyond the level of the cutting surfaces of the contiguous incisors, from which they are separated by a short *diastema*. The difference in size is much less considerable in the deciduous *molars*; it is most marked in the superior development of the second inferior molar of the *Orang*. The grinding surface of the anterior molars in the *Orang* is divided into two facets rising towards a middle transverse ridge, while the corresponding part of the grinding surface in the human first deciduous molar of the lower jaw is occupied by a depression.

Before proceeding to the description of the *cranium* of the adult *Orang*, which I take to belong to an unknown species of *Simia*, Erxl., I shall premise a few observations on those species, of the existence of which we have evidences from descriptions and specimens of the entire individuals, both young and full grown.

The two great islands of the Indian Ocean, Borneo and Sumatra, are each inhabited

by a large *Orang* or *Pongo*, alike in stature, which exceeds that of any other known *quadrumanous* animal: they are also similar in respect to the formidable nature of their dentition, but differ in the form of the *cranium*, and in some minor external characters.

The Bornean *Pongo*, if we may judge from the few specimens undoubtedly from that locality which exist in the Museums of this country, is clothed with loose long hair of a deep fuscous colour, approaching in some parts to black¹, the Sumatran *Pongo* is covered with loose long hair of a reddish brown colour². The adult male of the Bornean species has the countenance disfigured by large dermal callosities upon the cheek-bones³. These do not exist in either sex of the Sumatran species. The osteological differences relating to the structure and contour of the *cranium* have been described in my previous communication on this subject, and I now subjoin figures, of the natural size, of the *cranium* of an adult male, undoubtedly from Borneo, (Pl. XXXI. and XXXII.) a comparison of which with the figure of the (said to be Sumatran) *Orang's* *cranium*, (Pl. LIII. and LIV., vol. i. Trans. Zool. Soc.) will convey an adequate idea of the osteological difference alluded to. As the teeth in both these large species of *Orang* closely resemble each other both in form and size, it is impossible to determine from the germs of the permanent teeth in the numerous *crania* of immature *Orangs* in our Collections, to which of the species these *crania* should be referred. But this is certain, that the species called *Simia Satyrus* by Linnæus, and which Fischer inserts in his "Synopsis Mammalium," in addition to the *Simia Abelii* and *Simia Wurmbii*, is an *Orang Utan* in the immature state, and with the deciduous teeth. All the *crania* of the young *Orangs* which I have examined contain in the substance of the maxillary bones, germs of permanent teeth, which from their magnitude prove that the *crania* must have belonged to one or the other of the two great species above mentioned; but the characters of the *crania* themselves are too feebly developed in the immature state to lead to more than a conjectural determination as to which of the species they may belong.

With respect, however, to the *cranium*, now to be described, (Pl. XXXIII. and XXXIV.) the case is different. The condition of the teeth, which are all of the permanent series and far worn down, testifies that it is not the skull of a young *Orang*; while the size of the *cranium*, and the size and proportions of the teeth, indicate plainly the existence in Borneo of a species of *Orang* distinct from the great *Simia Wurmbii*, and altogether of a more anthropoid character. In this species, which I propose to call *Simia Morio*, the canine teeth are relatively smaller than in the female *Simia Wurmbii*; the whole series of the grinding teeth are smaller, while the superior incisors are nearly as large, and the inferior incisors quite as large, as those of *Simia Wurmbii*.

¹ See the young of this species No. 3, Zoological Society's Museum, and the specimen in the College of Surgeons.

² See the adult of this species, No. 2, *ibid.*

³ See the figure of the head of the male and female of this species, from specimens in the Royal Museum at Leyden, Saturday Magazine, No. 205, Sept. 12, 1835, p. 100.

The teeth in the jaws of a *quadrumanous cranium* may be known to belong to the permanent series, not only by their size and shape, but by the absence of the *foramina*, which, in an immature *cranium*, are situated behind the deciduous teeth, and which lead to the cavities containing the crowns of the permanent teeth. The character afforded by these *foramina* is well displayed on comparing together the *cranium* of the *Simia Morio* with one of a young *Simia Satyrus*, in which the deciduous teeth are present together with the first permanent *molars*. The deciduous teeth in the young *Orang*, besides their smaller size, have their fangs more or less protruded from their sockets, and they are thrust apart from one another by the interposition of the osseous particles which are deposited to enlarge the jaw for the lodgement of their large successors; while in the *Simia Morio* the teeth are lodged firmly in the jaws, and with the exception of the characteristic interval between the canines and incisors in the upper jaw, and the canines and *bicuspid*es in the lower jaw, are compactly arranged in close contiguity with each other.

That the *cranium* of the *Simia Morio* here described, belonged to an adult, is proved by the small interval between the temporal ridges at the crown of the skull, corresponding to the extensive surface of origin of the *crotophyte* muscles; and by the obliteration of the intermaxillary sutures: that it belonged also to an aged individual is highly probable from the extent to which the teeth are worn down, and from the obliteration, notwithstanding the absence of interparietal and lambdoidal crests, of the sagittal and lambdoidal sutures.

The cerebral portion of the skull of *Simia Morio* equals in size that of the *Pongo*, and indicates the possession of a brain at least as fully developed as in that species, while the maxillary portion is proportionally smaller; so that, as the *cranium* rises above the orbits, and is, like that of the *Pongo*, more convex on the coronal aspect than in the *Chimpanzee*, and wants the prominent supraciliary ridge which characterizes the African species, it presents in the *Simia Morio* altogether a more anthropoid character.

There are, however, the rudiments of the ridges which so remarkably characterize the *cranium* of the mature *Pongo*. Those which commence at the external angle of the frontal bone pass backwards, upwards, and slightly converge, but do not meet; they gradually diminish in breadth, and, after passing the coronal suture, subside to the level of the skull; they are then only traceable by a rough line, which leading parallel to the sagittal suture, and gradually bending outwards, rises again to be continued into the lambdoidal ridges; thus circumscribing the origins of the temporal muscles. The lambdoidal and mastoid ridges are broader and more developed than in the *Chimpanzee*, but inferior in both respects to those of the *Pongo*. The inial region of the *occiput* is almost smooth, and is convex, without the mesial ridge, and strong muscular impressions observable in the *Pongo*, where a preponderating weight in front calls for the insertion of powerful muscles behind to counterbalance it.

The temporal bones join the frontal in *Simia Morio* as in the *Troglodytes niger*; but

this structure occasionally is present on one or both sides of the skull in *Simia Satyrus*.

The *additamentum suturæ lambdoidalis* is present on both sides in the *Simia Morio*, and the beginning of the lambdoidal suture may be faintly traced, but the remainder is obliterated.

Directing our attention to the base of the skull of *Simia Morio* we observe the occipital *foramen* to be less posteriorly situated than in the *Pongo*, but more so than in the *Chimpanzee*. The plane of the *foramen* is also less oblique than in the *Pongo*. The occipital condyles are as far apart anteriorly as in the *Chimpanzee*. The anterior condyloid *foramina* are double on each side as in the *Pongo*: the carotid and jugular *foramina* open within the same depression; they are relatively further apart in the *Chimpanzee*: the petrous portion of the temporal bone, as in the *Pongo*, is relatively smaller than in the *Chimpanzee*; and the articular cavity, or surface for the lower jaw, forms a larger proportion of the base of the skull.

The other characters of the *basis cranii* correspond with those of the *Pongo*; and the smaller size of the *meatus auditorius externus* is probably associated in both species with a smaller auricle as compared with the *Chimpanzee*.

On the bony palate the relative position of the *foramen incisivum* corresponds with the development of the incisive teeth, showing the intermaxillary bones to be of larger size in the *Simia Morio* than in the *Chimpanzee*: the situation of the sutures joining these bones to the maxillaries is indicated by vascular grooves, but otherwise obliterated; while in the *cranium* of a young *Pongo* of nearly the same size as that of the *Simia Morio*, the intermaxillary sutures still remain, corresponding to the non-development of the permanent lanianaries. It will be interesting to determine at what period these sutures are obliterated in the more anthropoid *Simia Morio*.

The *os nasi* is a single narrow long triangular bone, slightly dilated at its upper end or apex, with the basal margin entire, presenting no indications of original separation into two parts, as has been observed in skulls of the *Chimpanzee*.

In the contraction of the interorbital space, and the general form of the orbit and its boundaries, the *Simia Morio* resembles the *Simia Satyrus*, but the orbital cavity, as before observed, is smaller. In the plane of the orbit and straight contour of the upper jaw, the *Simia Morio* resembles the Bornean species of *Pongo* or *Simia Wurmbii*, rather than the *Simia Abelii* or Sumatran *Pongo*.

The orbital process of the *os malæ* is perforated in the *Simia Morio* as in the *Pongo*, by several large *foramina*. There are one principal and two very small infraorbital *foramina* on either side; the upper maxillary bones are relatively smaller, as compared with the other bones of the face, and especially the intermaxillaries, than in the *Pongo*; a structure which coincides with the smaller proportional development of the canine teeth. The nasal aperture has the same form as in the adult *Simia Wurmbii*, being more elongated than in the immature *Orang*.

The main and characteristic difference then between the *Simia Morio* and the *Pongo*, whether of Borneo or Sumatra, obtains in the size of the laniary or canine teeth, to the smaller development of which in the *Simia Morio*, almost all the other differences in the *cranium* are subordinate or consequent¹. The laniary teeth, it may be observed, have little relation to the kind of food habitual to the *Orangs*; had they been so related they would have been accompanied with a structure of the glenoid cavity fitting them, as in the true *Carnivora*, to retain a living prey in their gripe, till its life was extinguished or resistance effectually quelled. But the flattened surfaces on which the condyles of the lower jaw rotate are in subserviency to the broad tuberculate molars, showing the mastication of vegetable substances to be the habitual business of the jaws,

¹ With respect to minor differences not noticed in the description, these may be deduced from the subjoined table of comparative admeasurements.

	<i>Simia Morio</i> , adult.		<i>Simia Wurmbeii</i> , adult male.	
	inch.	lin.	inch.	lin.
Length of the skull from the <i>vertex</i> to the base of the occipital condyle.	3	7	4	6
Length of the skull from the posterior plane of the <i>occiput</i> to the margin of the incisors	7	10	10	6
Length of the skull from the posterior plane of the <i>occiput</i> to the fronto-nasal suture	4	4	5	3
Length of the skull from the fronto-nasal suture to the margin of the incisors	4	1½	5	7
Greatest lateral diameter of the skull (at the post-auditory ridges).....	4	8	5	4
Smallest lateral diameter of the skull (behind the orbits)	2	4	2	9
Distance between temporal ridges	0	7	0	0
Diameter of the skull at the <i>zygomata</i>	5	1	6	9
Length of the zygomatic <i>fossa</i>	1	9	2	6
Diameter of skull taken between the outsides of the orbits	3	6	4	6
Interorbital space	0	4	0	7
Transverse diameter of orbital cavity	1	3	1	6
Vertical diameter of orbital cavity.....	1	6	1	7
Vertical diameter of nasal aperture	1	1	1	6
Transverse diameter of nasal aperture	0	9	1	0
Interspace between infraorbital <i>foramina</i>	1	7	2	0
Distance between the inferior margin of the nasal bone and the inferior margin of the intermaxillary bone	2	5	3	3
From the anterior margin of the occipital <i>foramen</i> to the posterior margin of the bony palate	2	3	2	10
Length of the bony palate along the mesial suture	3	1½	4	0
From the anterior margin of the intermaxillary bones to the anterior palatal <i>foramina</i>	0	10	1	3
Breadth of the crown of the first incisor, upper jaw	0	6	0	7
Breadth of the crown of the second incisor, upper jaw	0	3½	0	4
Breadth of the four incisors, <i>in situ</i> , upper jaw	1	6	1	9
Longitudinal extent of grinding surface of the <i>molares, bicuspides</i> included, of one side, upper jaw	2	2	2	5
Length of the enamelled crown of the canine tooth, upper jaw	0	6½	1	0
Breadth of ditto	0	5	0	9
Length of the lower jaw from the condyle to the anterior surface of the sockets of the incisors	5	7	7	4
Length of the <i>ramus</i> of the lower jaw	3	4	4	7½
Greatest breadth of ditto	2	0	3	1
Interspace between the mental <i>foramina</i>	1	8	2	1

and the application of the laniaries to be occasional, and probably defensive in most cases. The utility of formidable canine teeth to the *Orangs*, whose stature makes them conspicuous and of easy detection to a carnivorous enemy, is obvious; such weapons, in connexion with the general muscular strength of the *Pongos*, may enable them to offer a successful defence against a large feline antagonist; but in the smaller species, which we have been describing, to which concealment would be easier, the canines are of relatively smaller size, and those of the lower jaw are so placed as to be worn down by the lateral incisors of the upper jaw; they were reduced in the specimen described, to the level of the other teeth; and the points of the upper canines were also much worn. The size, forms, and proportions of the teeth which relate more immediately to the food of the *Orangs*, viz., the molars and incisors, show indisputably that the *Simia Morio* derives its sustenance from the same kind of food as the larger *Orangs*. The singular thickness or antero-posterior diameter of the incisors, which are worn down to a flattened surface, like molar teeth, show that they are put to rough work; and it is probable that their common use is to tear and scrape away the tough fibrous outer covering of the cocoa-nut, and, perhaps, to gnaw through the denser shell.

PLATE XXX.

- Fig. 1. Side view of the *cranium* of an immature *Simia Wurmbii*, showing part of the permanent series of teeth in place.
 2. Front view of the jaws of the same.
 3. Grinding surface of the teeth of the lower jaw, (the mark \times denotes the lateral deciduous incisor not yet thrust out.)

PLATE XXXI.

Side view of the *cranium* of the adult *Simia Wurmbii*; with a front view of the incisors and canines.

PLATE XXXII.

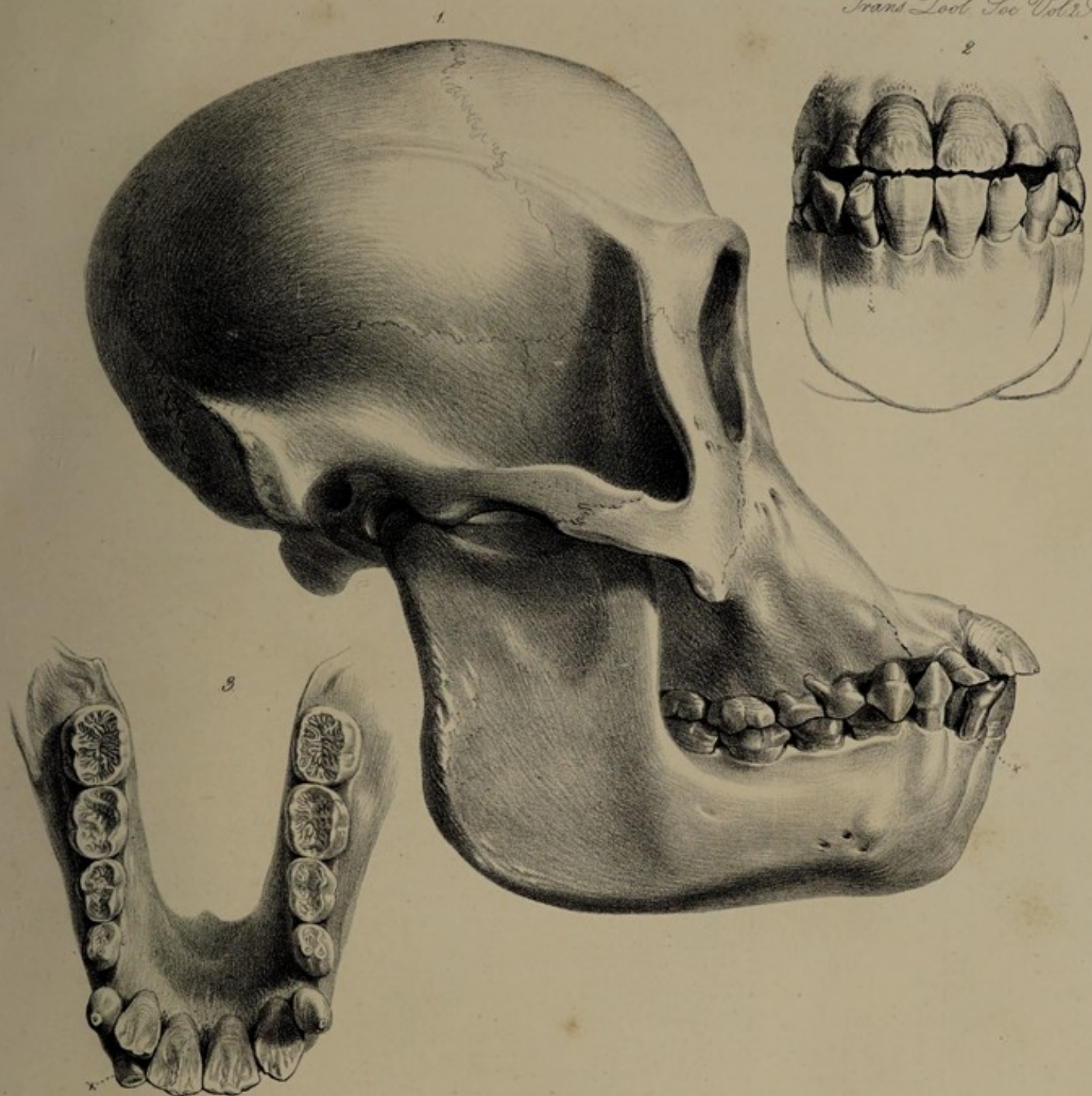
Base view of the *cranium* of the adult *Simia Wurmbii*.

PLATE XXXIII.

Side view of the *cranium* of *Simia Morio*, with a front view of the incisors and canines.

PLATE XXXIV.

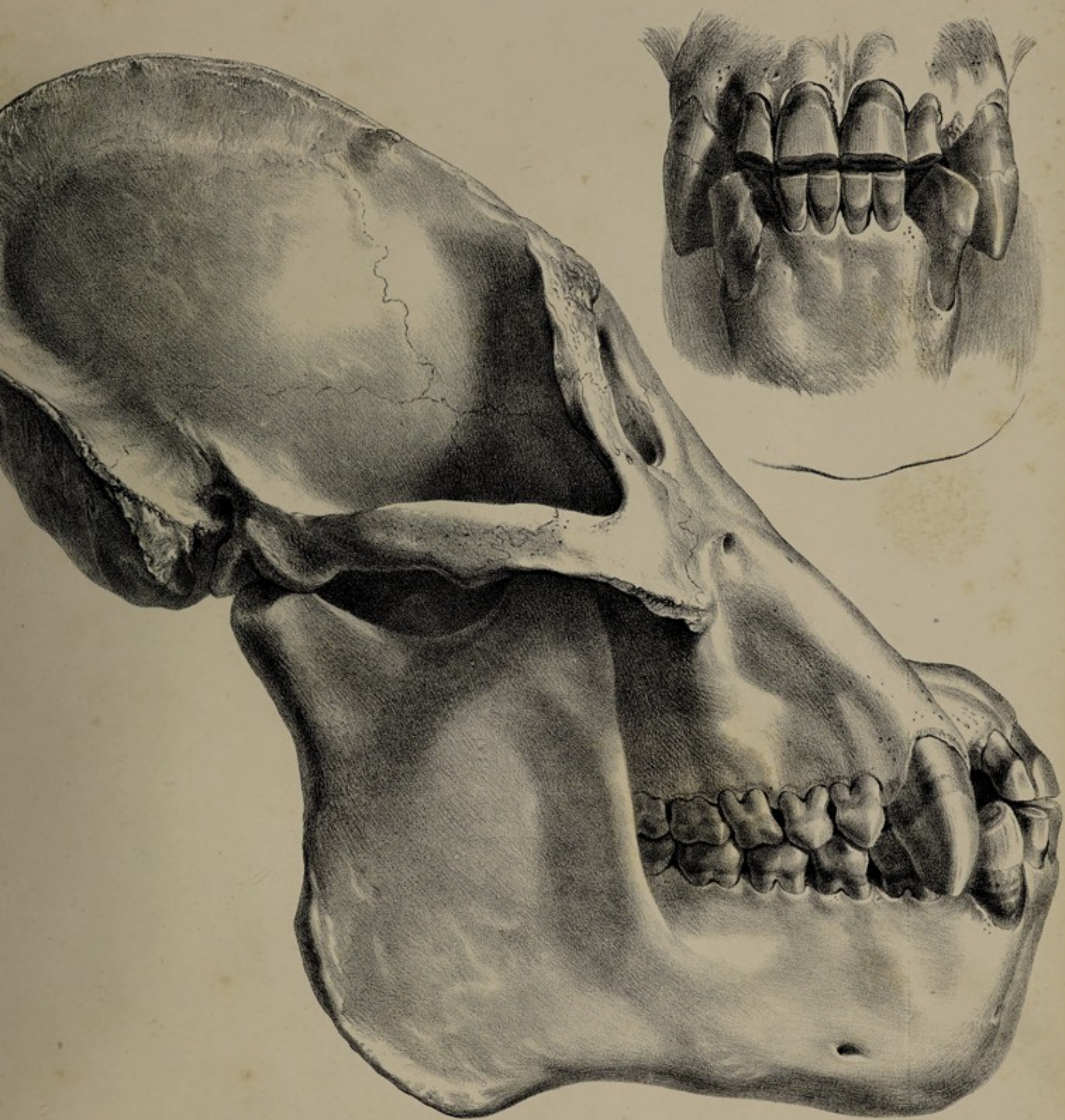
Base view of the *cranium* of *Simia Morio*.



G. Scharf del. et lithog.

Printed by C. Hallmandel.

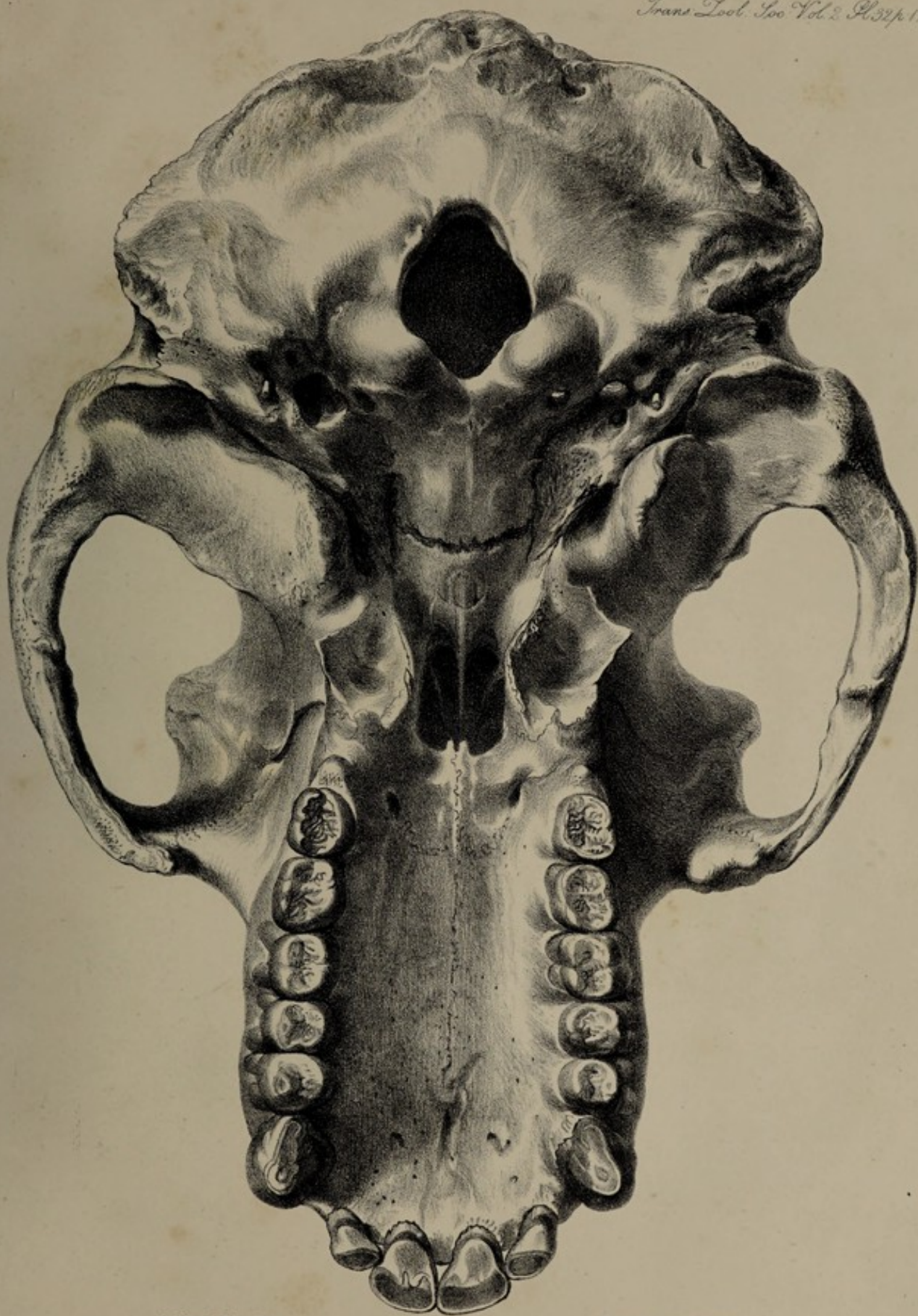
Simia Wombii
(immature)



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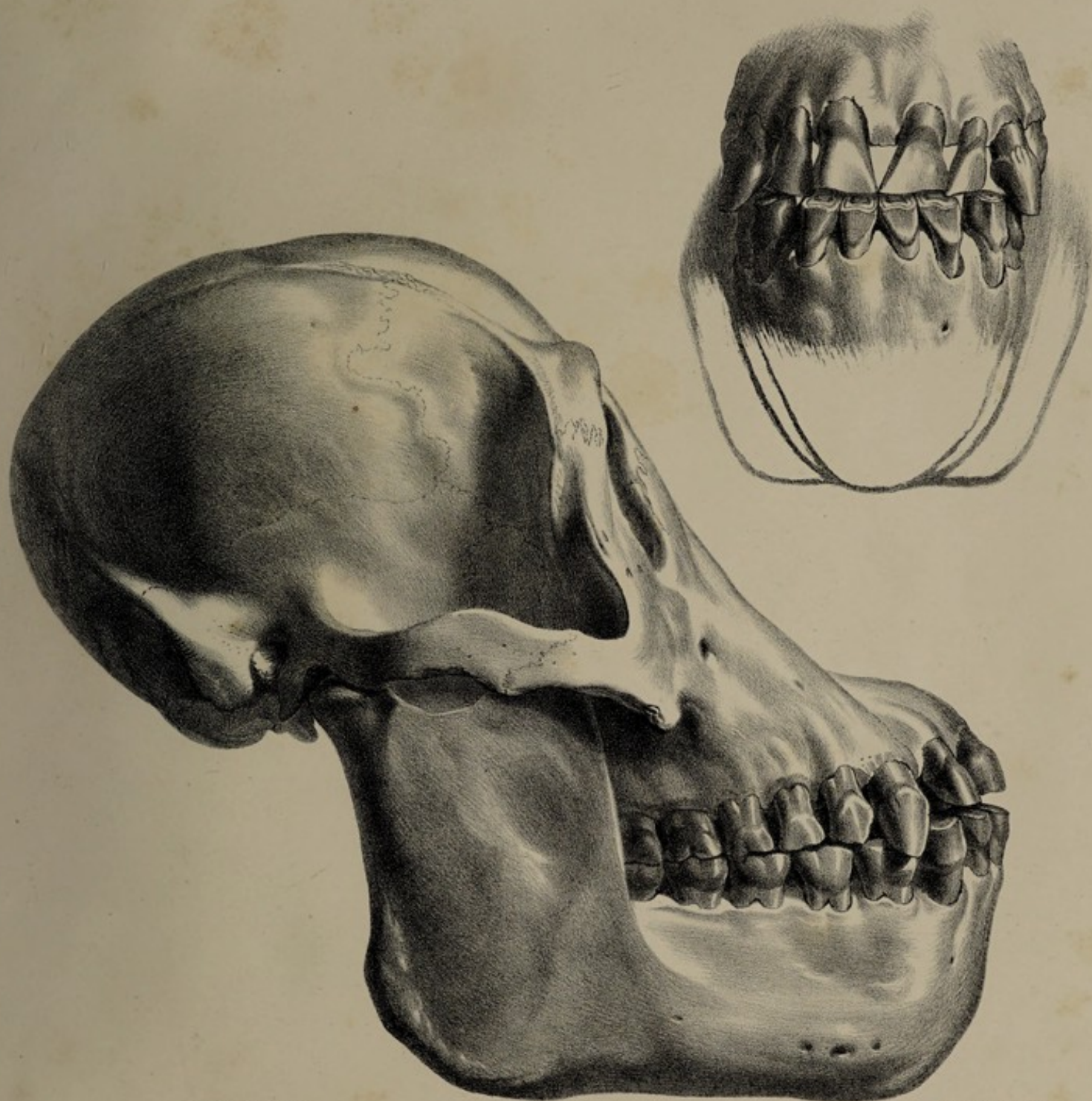
Simia Wormbe



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Printed by C. Bellmandel.

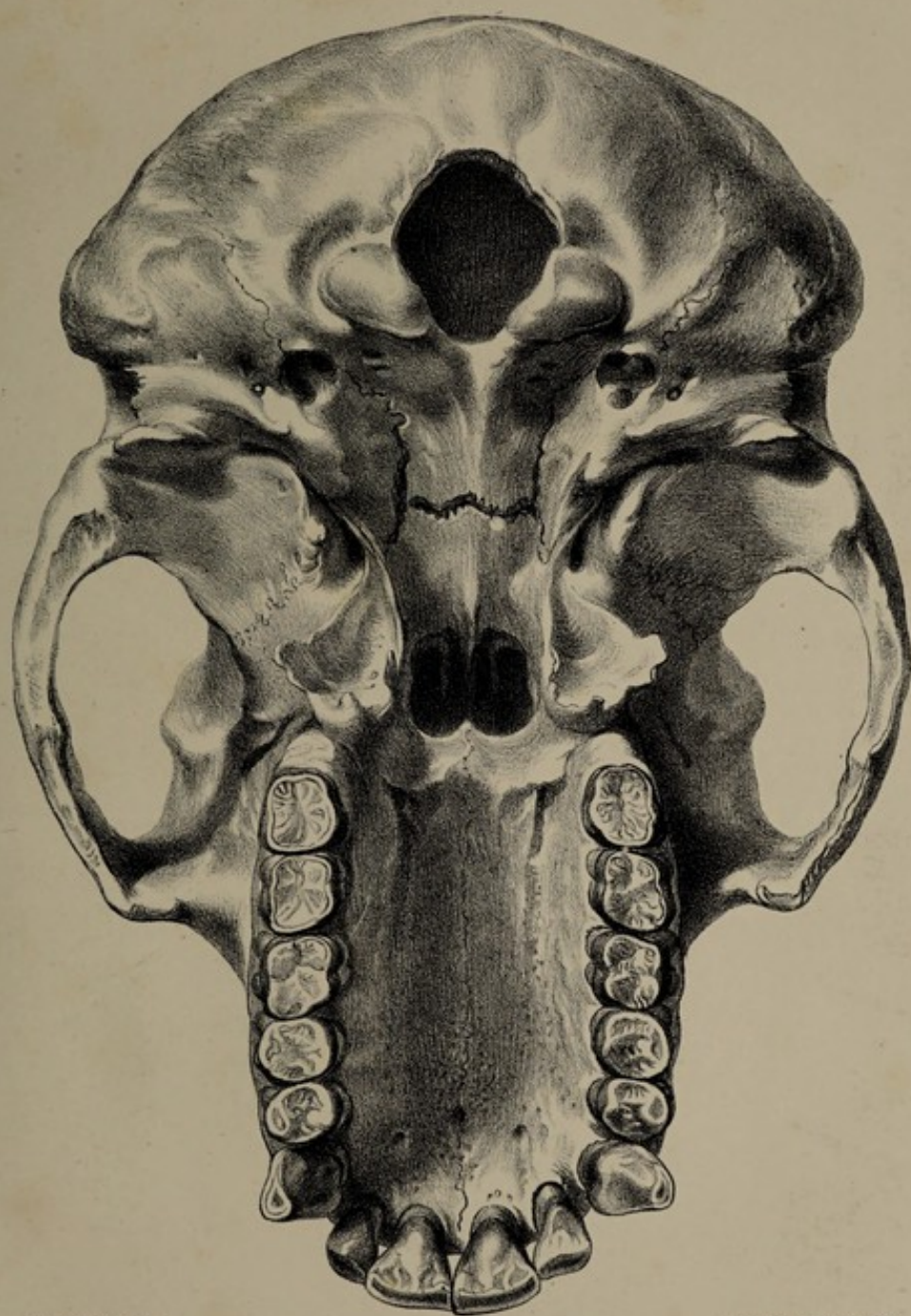
Simia Wormbe



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Simia Morio

