VII. *Description of the Living and Extinct Races of Gigantic Land-Tortoises.*—Parts I. & II. *Introduction, and the Tortoises of the Galapagos Islands.* *By* Dr. Albert Günther, *F.R.S., V.P.Z.S., Keeper of the Zoological Department of the British Museum.*

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Part I.—INTRODUCTION.

In 1865 and following years the Trustees of the British Museum obtained a series of Tortoise-bones from the Mauritius, chiefly due to transmission by Mr. George Clark, C.M.Z.S. It consisted of limb-bones and portions of the cranium; and particular interest was attached to it, as these remains had been found associated with the bones of the Dodo, and as the race of these reptiles had shared the fate of that remarkable bird, having long ago succumbed to the onslaught of the numerous enemies who took possession of their limited home.

The circumstances under which these bones were found will be readily understood from the following abstract of Mr. Clark's "Statement"*:—

"On the estate called 'Plaisance,' about three miles from Mahébourg, in the island of Mauritius, there is a ravine of no great depth or steepness, which, apparently, once conveyed to the sea the drainings of a considerable extent of circumjacent land, but which has been stopped to seaward, most likely for ages, by an accumulation of sand extending all along the shore. The outlet from this ravine having been thus impeded, a sort of bog has been formed, called 'La Mare aux Songes,' in which is a deposit of alluvium, varying in depth, on account of the inequalities of the bottom, which is formed of large masses of basalt, from 3 to 10 or 12 feet. The proprietor of the estate, a few weeks ago, conceived the idea of employing this alluvium as manure; and shortly after, the men began digging in it; when they had got to a depth of 3 or 4 feet they found numerous bones of large tortoises, among which were a carapace and a plastron pretty nearly entire, as also several crania. . . . . These were found imbedded in a black vegetable mould, the lighter-coloured specimens being near the springs."

My attention was directed to these remains in the year 1872, when I received from my esteemed correspondent, L. Bouton, Esq., a further consignment of Chelonian bones, consisting:—

1. "Of the carapace of a Tortoise found at Grand Port, a few years ago, in the same place where the bones of the Dodo were also found—in a marshy place called 'Mare aux Songes.'" [This appears to be the carapace mentioned in the above statement but no plastron was received with it then or afterwards.]

* See Trans. Zool. Soc. vi. p. 51.

2. "Of bones from Mauritius, very abundant in the district of Flacq."

3. "Of bones from the island of Rodriguez"*.

Similar bones had been discovered and had reached Europe many years ago. In the year 1830 M. J. DESJARDINS, one of the first explorers of the fauna of Mauritius, had discovered "three deposits of the remains of Tortoises"†. The same naturalist sent a bone of a Tortoise, found, in 1786, in a cave in Rodriguez, with some remains of the Solitaire to Paris‡, where they were examined by CUVIER and BLAINVILLE, who erroneously stated them to have been recently found under a bed of lava in Mauritius §. Another Mauritian naturalist, C. TELFAIR, in searching, in 1832, for bones of the Solitaire in Rodriguez, succeeded in obtaining "numerous bones of the extremities of one or more large species of Tortoise," which were presented to the Zoological Society of London, and exhibited at one of the Meetings ‖. These bones were still in the possession of the Society three or four years before the publication of STRICKLAND and MELVILLE'S memoir on the Dodo (1848)¶; but no further attention being paid to them, they were lost. Another portion of TELFAIR'S collection was presented by him to the Andersonian Museum at Glasgow.

The causes of the indifference with which these remains were treated are twofold:—First, the all-absorbing interest centred in the bird-remains; and, secondly, the belief that the bones were those of a still-existing gigantic species of Tortoise commonly called *Testudo indica*. Under this name were comprised all gigantic Land-Tortoises brought to Europe in ships which, on their return from India, had touched at the Mascarenes. When, at a later period, zoologists became acquainted with a similar Tortoise from the Galapagos Islands, some considered the latter specifically distinct, whilst others maintained that they were specimens of the same species, "which had been scattered by man in different tropical parts of the globe" (GRAY, Shield Rept. 1855, p. 7).

However, a closer examination and comparison of the remains at my disposal revealed important differences unmistakably pointing at a multiplicity of species; and as the remains were of a comparatively very recent period, so that I could reasonably expect to find carapaces, skeletons, or even stuffed examples of the very same species in our collections, it became imperative, for the proper interpretation of the Mauritian remains, to include in my researches the forms known or supposed to be still living. The results of these researches were startling, and may arrest the attention of the zoologist all the more, as the facts elucidated bring us face to face with the mystery of the birth and life of an animal type. I may shortly indicate them as follows:—

1. Mauritius and Rodriguez were formerly inhabited by several species of gigantic Tortoises, the Rodriguez species differing more markedly from those of Mauritius than

* Letter from L. BOUTON, Esq., dated Oct. 18, 1872.

† Proc. Comm. Zool. Soc. i. p. 45.

‡ Proc. Comm. Zool. Soc. i. p. 111; STRICKLAND and MELVILLE, 'The Dodo,' pp. 51, 53.

§ Edinb. Journ. Nat. Sc. iii. p. 30.

‖ Proc. Zool. Soc. 1833, p. 31.

¶ With a dismay excusable in an ornithologist, STRICKLAND exclaims (*l. c.* p. 52), "Alas! the bones of the Solitaire, apterous as it was, had flown away, and the only bones that remained belonged to *Tortoises*!"

these latter among themselves. All these species appear to have become extinct in modern times.

2. These extinct Tortoises of the Mascarenes are distinguished by a flat cranium, truncated beak, and a broad bridge between the obturator foramina.

3. All the recent examples of gigantic Tortoises in our museums said to have been brought from the Mascarenes, and the single species which is known still to survive in a wild state in the small island of Aldabra, have a convex cranium, trenchant beak, and a narrow bridge between the obturator foramina, and are therefore specifically, if not generically, distinct from the extinct ones.

4. On the other hand there exists the greatest affinity between the extinct Mascarene Tortoises and those still inhabiting the Galapagos group. The latter must be considered to be indigenous to this archipelago.

5. Among the Galapagos Tortoises five species can be distinguished at present; they are inhabitants of different islands of the group.

I propose to preface my detailed description of the various species by a general account of the historical evidence given by travellers who have met with those Tortoises, whilst the scientific part of the literature will be better referred to in the descriptions of the several species.

Historical evidence.

Nearly all the voyagers of the 16th and 17th centuries who have left accounts of their adventures and discoveries in the Indian and Pacific Oceans mention the occurrence, in certain isolated islands or groups of islands, of gigantic Land-Tortoises in countless numbers. The islands on which they met with these animals, although all between the equator and southern tropic, form two most distant zoological stations, widely different in their physical characteristics. One of those stations was the Galapagos Islands, the other comprised Aldabra, Réunion, Mauritius, and Rodriguez. But they had this in common, that at the time of their discovery they were uninhabited by man or even some larger terrestrial mammal. Not one of those voyagers ever mentions having met with those Tortoises in any other island of the tropics or in any portion of the Indian continent; and it is not likely that one or the other should not have mentioned the fact if he had seen them in some novel locality. In fact the hardy sailors of that period took the greatest interest in these animals, which were to them a most important article of food. At a time when a voyage now performed in a few weeks took as many months, when every vessel, for defence' sake and from other causes, carried as many people as it was possible to pack into her, when provisions were rudely cured and but few in kind, those tortoises which could be captured in any number with the greatest ease within a few days proved to be a most welcome addition to the stock. The animals could be carried in the hold of the ship or in any other part, without food, for months, and were slaughtered as occasion required, each tortoise yielding, according to size, from 80 to 200 pounds of whole-

some food. Thus we are informed that ships leaving the Mauritius or the Galapagos used to take upwards of 400 of these animals on board.

When we consider that these helpless creatures lived in perfect security from all enemies, and that nature had endowed them with great longevity *, so that the individuals of many generations lived simultaneously in their island home, we can well account for the multitudes found by the first visitors to those islands.

Leguat (1691) says that "there are such plenty of Land-Turtles in this isle (Rodriguez) that sometimes you see two or three thousand of them in a flock, so that you may go above a hundred paces on their backs." Down to 1740 they continued to be numerous in Mauritius; for Grant (Hist. Maurit. p. 194) writes in that year, "We possess a great abundance of fowl as well as both Land- and Sea-Turtle, which are not only a great resource for the supply of our ordinary wants, but serve to barter with the crews of ships who put in here for refreshment in their voyage to India!" Yet they appear to have been much more scattered in the larger island than in Rodriguez; and, according to Admiral Kempinfelt, who visited the latter island in 1761 (see Grant's Maurit. p. 100), small vessels were constantly employed in transporting these animals by thousands to Mauritius for the service of the hospital. Soon, however, their numbers appear to have been rapidly diminished; the old ones were captured by man, the young ones devoured by pigs. Numbers must have succumbed in consequence of the numerous conflagrations by which the rank vegetation of the plains was destroyed to make room for the plantations of the settler. Early in the present century the work of extermination appears to have been accomplished; and there is at present not a single living example either in the Mauritius, in Rodriguez, or Réunion; a few isolated individuals are kept in a state of captivity in the Seychelles, imported from the island of Aldabra, the only spot in the Indian Ocean where this Chelonian type still lingers in a wild state in small and gradually diminishing numbers †. That this Tortoise from Aldabra is specifically distinct from the extinct ones of the Mauritius and Rodriguez, we shall see subsequently.

In the second place, I have to refer to the accounts given by the most trustworthy visitors to the Galapagos Islands. According to the unanimous testimony of geographers, the first discoverers of this archipelago, the Spaniards, found the islands so

* On this point the testimony is unanimous and not to be doubted: in fact all Tortoises are long-lived. Mr. E. W. H. Holdsworth, F.L.S., informs me of an individual carried to Ceylon (Colombo), and said to have lived in the island for 150 years. Another example, in Cerf Island, is known to have been kept there for the last 70 years (unfortunately its present owner asks a price for it commensurate to its age). A very young living example from Aldabra, 7 inches long, sent to me by Dr. W. M'Gregor, is now 3 years old.

† I am indebted to His Excellency Sir Arthur Gordon, Governor of the Mauritius, for this information. I may add, from my own experience, that the Aldabra species is but rarely brought to London now. In the years 1857–59 I saw several large living examples brought into the London market, and one which I bought for £4 was considered to be dear. Since that time I have heard of one adult only, beside the young sent to me by Dr. M'Gregor. However, they are not readily sold, as hitherto none of them have been kept alive in England for any length of time, and most zoological museums possess specimens of this species.

thickly peopled with Tortoises that they applied the Spanish word for tortoise to their discovery. In DAMPIER'S time (1680) it was the common practice of vessels to visit those islands for a supply of water and tortoises. In his 'New Voyage round the World' (Lond. 1697, 8vo), p. 101, he says:—"The Land-Turtle are here so numerous that 5 or 600 men might subsist on them alone for several months, without any other sort of provision. They are extraordinary large and fat, and so sweet that no pullet eats more pleasantly. One of the largest of these creatures will weigh 150 or 200 weight [pounds], and some of them are 2 foot or 2 foot 6 inches over the callapee or belly [across the sternum]. . . . . They have very long small necks and little heads."

The condition of this group of islands and of the animals inhabiting them appears to have been unaltered when they were visited by AMASA DELANO and DAVID PORTER, the former a captain in the merchant service, the latter in the navy of the United States.

DELANO ('Narrative of Voyages and Travels,' Boston, 1817, 8vo) made several visits to the Galapagos, the first in 1800 (p. 369). He found plenty of Tortoises in Hood's, Charles, James, and Albemarle Islands. He gives a good description of them, noticing particularly the long, serpent-like neck (p. 376):—"I have seen them with necks between two and three feet long . . . . They would raise their heads as high as they could, their necks being nearly vertical, and advance with their mouths wide open . . . . They are perfectly harmless. . . . I have known them live several months without food; but they always in that case grow lighter, and their fat diminishes. . . . I carried at one time from James Island 300 very good terrapins to the island of Massa Fuero; and there landed more than one half of them, after having them more than 60 days on board my ship. Half of the number landed died as soon as they took food . . . . those that survived the shock which was occasioned by this sudden transition from total abstinence to that of abundance soon became tranquil, and appeared to be as healthy and as contented with the climate as when they were at their native place; and they would probably have lived as long, had they not been killed for food. . . . I have carried them to Canton at two different times."

PORTER informs us of many interesting particulars in his 'Journal of a Cruise made to the Pacific Ocean' (New York, 1822, 8vo, in 2 vols.). He found the Tortoises (in 1813) in greater or less abundance in all the larger islands of the group which he visited, viz. Hood's, Marlborough, James, Charles, and Porter's (Indefatigable) Islands. On Chatham Island, where he made a short stay, a few of their shells and bones were seen, but they appeared to have been long dead (vol. i. p. 231); and on Albemarle Island, the largest of the group, none were observed by him, evidently because he landed here only for a few hours on the south-western point. Abingdon, Binloe, Downe, and Barrington Islands were not visited by him. Some of the Tortoises captured weighed from 300 to 400 pounds (p. 127). "Their steps are slow, regular, and heavy; they carry their body about a foot from the ground. . . . Their neck is from 18 inches to 2 feet in length,

and very slender; their head is proportioned to it, and strongly resembles that of a serpent. . . . . No animal can possibly afford a more wholesome, luscious, and delicate food than they do. . . . What seems the most extraordinary in this animal is the length of time that it can exist without food; for I have been well assured that they have been piled away among the casks in the hold of a ship, where they have been kept eighteen months, and when killed at the expiration of that time were found to have suffered no diminution in fatness or excellence. They carry with them a constant supply of water in a bag at the root of the neck, which contains about two gallons; and on tasting that found in those we killed on board, it proved perfectly fresh and sweet. . . . In the daytime they appear remarkably quick-sighted and timid, drawing their head into their shell on the slightest motion of any object; but they are entirely destitute of hearing, as the loudest noise, even the firing of a gun, does not seem to alarm them in the slightest degree; and at night, or in the dark, they appear perfectly blind" (p. 150). Near a bay on the north-east part of James Island, PORTER took on board as many as would weigh about 14 tons, the individuals averaging about 60 pounds—that is, about 500 individuals (p. 214); and he states that "among the whole only three were male, which may be easily known by their great size, and from the length of their tails, which are much longer than those of the females. As the females were found in low sandy bottoms, and all without exception were full of eggs, of which generally from ten to fourteen were hard, it is presumable that they came down from the mountains for the express purpose of laying. This opinion seems strengthened by the circumstance of there being no male Tortoises among them, the few we found having been taken a considerable distance up the mountains. . . . . The temperature of the air of the Gallipagos Islands varies from 72° to 75°; that of the blood of the Tortoise is always 62°. . . . The eggs are perfectly round, white, and of $2\frac{1}{2}$ inches diameter" (pp. 215, 216).

Very significant are PORTER'S remarks as regards the differences of the Tortoises from different islands. On Porter's Island "they were generally of an enormous size, one of which measured $5\frac{1}{2}$ feet long, $4\frac{1}{2}$ feet wide, and 3 feet thick; and others were found by some of the seamen of a larger size" (p. 164). "The shells of those of James Island are sometimes remarkably thin and easily broken, but more particularly so as they become advanced in age. . . . . Those of James Island appear to be a species entirely distinct from those of Hood's and Charles Islands. The form of the shell of the latter is elongated, turning up forward in the manner of a Spanish saddle, of a brown colour, and of considerable thickness. They are very disagreeable to the sight, but far superior to those of James Island in point of fatness, and their livers are considered the greatest delicacy. Those of James Island are round, plump, and black as ebony, some of them handsome to the eye; but their liver is black, hard, when cooked," &c. (pp. 214, 215). The Tortoises of Hood's Island were small, similar to those of Charles Island (p. 233).

Before we pass from PORTER to his successors we must mention that he proceeded,

after his cruise round the Galapagos, to the Marquesas Islands, making a prolonged stay at Madison Island, where he "distributed from his stock several young Tortoises among the chiefs, and permitted a great many to escape into the bushes and among the grass" (vol. ii. p. 109).

Captain JAMES COLNETT'S visit to the Galapagos archipelago deserves to be mentioned only because he adds Abingdon Island to the list of those in which Tortoises occur ('Voyage to the South Atlantic,' Lond. 1798, 4to, p. 152). Also Capt. BASIL HALL landed on this island in 1822, where he found plenty of large Tortoises, of which he laid in a stock which lasted the ship's company for many weeks ('Extracts from a Journal,' Edinb. 1824, 8vo, 2nd edit. vol. ii. p. 140).

Twenty-two years had passed since PORTER'S cruise, when DARWIN visited the Galapagos in the 'Beagle' in the year 1835. A change, by which the existence of these animals was much more threatened than by the casual visits of buccaneers and whalers, had taken place. The Republic of the Equator had taken possession of the archipelago, and a colony of between two and three hundred people banished by the Government had been established on Charles Island, who reduced the numbers of Tortoises in this island so much that they sent parties to other islands (for instance, James) to catch Tortoises and salt their meat ('Journal,' pp. 375, 376). Pigs had multiplied, and were roaming about in the woods in a feral state. DARWIN adds many interesting observations on the habits of these Tortoises; but as his 'Journal' is in everybody's hands, I quote from his account such parts only as have a special bearing on questions with which we shall have to deal in this treatise. He confirms PORTER'S observation as regards their deafness, also that "the old males are the largest, the females rarely growing to so great a size. The male can readily be distinguished from the female by the greater length of its tail" (p. 382). An egg which he measured was $7\frac{3}{8}$ inches in circumference, a measure nearly identical with that found by PORTER. "The old ones seem generally to die from accidents, as from falling down precipices. At least, several of the inhabitants told me they had never found one dead without some evident cause" (p. 384). "The Vice-Governor, Mr. LAWSON, declared that the Tortoises differed from the different islands, and that he could with certainty tell from which island any one was brought. . . . M. BIBRON, moreover, informs me that he has seen what he considers two distinct species of Tortoise from the Galapagos, but he does not know from which islands. The specimens that I brought from three islands were young ones, and, probably owing to this cause, neither Mr. GRAY nor myself could find in them any specific differences" (p. 394).

After an interval of not quite eleven years, H.M.S. 'Herald' followed the 'Beagle' on a voyage of discovery and survey. The naturalist of that expedition, which reached the Galapagos in the year 1846, found that the progress of civilization had been great ('Narrative of H.M.S. Herald,' by B. SEEMANN, Lond. 1853, 8vo), or, in other words, that the displacement of the indigenous fauna by man and his companions had proceeded apace. On Charles Island "the cattle had increased wonderfully, and were esti-

mated at 2000 head, beside wild pigs, goats, and dogs. . . . The wild dogs keep the goats and pigs very much down" (vol. i. p. 57); but "no turpin, or terrapin, are living on this island" (p. 59); that is, the Tortoises had been exterminated between the visits of the 'Beagle' and the 'Herald.' On Chatham Island "we saw, for the first time, the terrapin or galapago . . . . We bought them at the rate of six shillings apiece. They were 2 feet 2 inches in length, 1 foot 10 inches broad, standing 1 foot 2 inches off the ground." No specimens were brought home by this expedition.

We have no means of ascertaining from recent accounts the present condition of the indigenous fauna of these islands. Possibly most of the larger natural-history collections possess one or several examples of the Galapagos Tortoise; but the majority of specimens are young, or fragmentary, or without any history; and there will be found scarcely one with an indication of the particular island from which it came! Therefore the difficulties encountered by the zoologist who undertakes the study of these Tortoises will be easily understood.

There is no doubt that so singular an animal type as this Land-Tortoise, grown up within so well-defined an area as the Galapagos, and repeated with almost identical modifications of development at the opposite end of the globe, the Mascarenes, would have yielded the most valuable material towards solving the question of the genesis of species if a complete set of examples from every island had been secured for examination. This is now impossible, the causes of their extermination having been at work for so long a time. What happened in the Mascarenes has commenced in the Galapagos. From the account of the voyage of the 'Herald' there cannot be any doubt that of one race at least, that of Charles Island, we shall never see a complete example again; and with regard to the others, it will be most difficult to obtain one of those colossal individuals which required many scores of years of undisturbed life to attain to the size attested by Delano, Porter, and Darwin. Under these circumstances I could not hope that the scanty material preserved in British collections would be materially increased within the next years, or that science would be more benefited if this inquiry, already deferred too long, were put off to a later period; and, however incomplete the following account may appear, it will have this effect at least, that these animals, hitherto so much neglected in our collections, will be carefully preserved, and that advantage will be taken of every opportunity of contributing towards our better knowledge of them.

In the descriptive portion of this memoir I propose to treat of these Tortoises under three heads:—

1. The Tortoises of the Galapagos Islands.
2. The recent races of the Tortoises of the Mascarenes.
3. The extinct races of the Mascarenes.

Part II.—Description of the Galapagos Tortoises.

General Characters.

Tortoises inhabiting the Galapagos archipelago may be recognized and distinguished, more especially from the living Mascarene Tortoises, by the following characters:—

The nuchal plate is constantly absent.

The posterior margins of the two gular plates are convergent, meeting at a more or less obtuse angle, never forming a straight, or nearly straight, transverse line.

Neck and legs long.

The shell is black.

One of the scutes on the inner side of the elbow is conspicuous for its size, much larger than those surrounding it.

In the skull the crown is flat; the palate moderately concave; the front part of the intermaxillary truncated, elevated.

The symphyseal bridge between the foramina obturatoria of the pelvis is flat, broader than deep.

Osseous carapace very thin. Nuchal vertebræ and limb-bones elongate.

Among the carapaces which have formed a part of the material for this memoir, I can distinguish five forms; of the first four severally two are more nearly related to each other than to the other pair, the fifth being intermediate between these two pairs.

In the *first pair* the shell is of a broader form, with more or less corrugated plates; in the *second* it is elongate and perfectly smooth.

α. In one species of the first pair the shell is depressed, with the upper anterior profile subhorizontal in the male, and with the striæ of the plates not deeply sculptured; the sternum is truncated behind (Plate 33. fig. A): *Testudo elephantopus.*

β. In the other species the shell is considerably higher, with declivous anterior profile in the male, and with the striæ of the plates much more deeply sculptured; the sternum has a triangular excision behind (Plate 33. fig. B, and Plate 35. fig. C.): *Testudo nigrita.*

γ. In one species of the *second pair* the shell shows some traces of former concentric striæ, is compressed into the form of a "Spanish saddle" in front in the male; the sternum is truncated behind (Plate 34 and Plate 35. fig. B): *Testudo ephippium.*

δ. In the other species the shell is perfectly smooth, with declivous anterior profile in the male, and with truncated posterior extremity of the sternum (Plate 36): *Testudo microphyes.*

ε. In the last species the shell is depressed, as in the first, with the upper anterior profile subhorizontal in the male, and with the lateral anterior margins reverted so as to approach the peculiar shape of *T. ephippium*; the striæ are distinct and broad; sternum of peculiar shape, much constricted and produced in front, and expanded and excised behind (Plate 35. fig. A): *Testudo vicina.*

The degree of distinctness and affinity which obtains in the carapaces is expressed

clearly and in exactly the same manner in the skulls. In the skulls of the *broad* form of carapace and sternum the palatal region is more concave than in the other; the outer pterygoid edge is sharp in its entire length, or for the greater part of its length; there is a deep recess at the base of the skull in front of the occipital condyle, and the anterior wall of the entrance into the tympanic cavity is considerably constricted.

α. The first species (*T. elephantopus*) is distinguished by a very short snout, and by an immensely developed and raised occipital crest (Plate 38. fig. A).

β. In the second (*T. nigrita*) the facial portion is longer and the occipital crest low (Plate 38. fig. D).

In the skulls of the *narrow* form, the palatal region is shallow, the outer pterygoid edge flattened in its whole length; there is no deep recess at the base of the skull in front of the occipital condyle, and the anterior wall of the tympanic cavity is bulging outwards, not constricted.

γ. In *T. ephippium* the tympanic cavity is much produced backwards, the tympanic opening elliptic, and the impression in front of the tympanic pedicle is very shallow (Plates 37 & 38. fig. C).

δ. The skull of a perfectly adult *T. microphyes* is only 83 millims. long, and has the characteristics of a young skull of one of its more gigantic congeners, neither the occipital crest nor the tympanic case being produced backwards. The impression in front of the tympanic pedicle is rather deep (Plates 37 and 38. fig. B).

ϵ. Finally, the skull of *T. vicina* has all the characteristics of that of *T. ephippium*, but differs from it in having a circular tympanic opening.

These observations fully bear out Porter's and Darwin's statements that the various islands are inhabited by distinct species. Unfortunately we do not possess positive and exact information as regards the localities whence our examples were obtained; but Porter's accounts are sufficiently detailed to enable us to relegate with more or less ce tainty some of the species before us to the places of their nativity. James Island yielded Tortoises of the broad, circular type; and therefore either *T. elephantopus* or *T. nigrita* came from that island, probably the former. There can be no doubt that we have in *T. ephippium* the species inhabiting Charles Island; and *T. microphyes* is most probably the representative from Hood's Island. We may suppose that other specific forms exist; but there is no evidence of them in the material before me.

In young examples, which are rather common in collections, the distinctive characters, external or osteological, are incompletely developed, so that it is, at present, extremely difficult and somewat hazardous to refer very young individuals (up to about 15 inches in length) to the species to which they belong. This resemblance of young examples cannot be used as an argument against the distinctness of the various species, as generally, in Vertebrates as well as Invertebrates, specific characters are not developed before a certain period, which varies exceedingly even in groups nearly related to one another.

Specific Descriptions.

1. *Testudo elephantopus.*

The Tortoise to which Harlan (Journ. Ac. Nat. Sc. Philad. v. 1825, p. 284) gave this name was only 21 inches long over the curvature, or about 17 inches in a straight line, and therefore a young animal. A reference to the measurements and figure given by Harlan shows clearly that he had an animal with the broad form of the body and with a posteriorly truncated sternum, characteristics by which a small series of examples before me are distinguished, and more especially one individual of nearly the same size as that described by Harlan.

Duméril and Bibron (Erpétol. Génér. ii. p. 115) identify Harlan's example with one deposited by Quoy and Gaimard in the Paris Museum under the name of *Testudo nigra*. This specimen is still smaller than Harlan's, and of an age at which the specific characters are not yet developed; and therefore there is no evidence whatever to show that this identification by Duméril and Bibron is correct; and as long as it is uncertain to which of the specific forms the young "*T. nigra*" should be referred, the name had better be disused altogether. Duméril and Bibron associate with this young specimen another of large size, distinguished by its broad form, smooth plates, and posteriorly excised sternum, but without giving any convincing proof that these two examples are of the same species. I have not seen an example agreeing in all points with that large example, and it may possibly be another species distinct from those described here.

The materials which I refer to *T. elephantopus* are the following:—

1. An adult male example: a perfect skeleton with carapace, but without epidermoid plates. The carapace is 31 inches long. History of the specimen unknown; property of the Oxford Museum, and kindly lent to me by Professor Rolleston, F.R.S. (Plate 33. fig. A).

2. An immature female example: a perfect skeleton with carapace, but without epidermoid plates. The carapace is 28½ inches long. *Hab.* Galapagos Islands. Property of the Royal College of Surgeons. Notes on this example by Professor Owen in Descript. Catal. Osteol. Ser. R. Coll. Surg. i. 1853, p. 194. no. 1011.

3. Carapace, without epidermoid plates, of an immature male example, 23 inches long. History unknown. Property of the Free Public Museum, Liverpool.

4. Carapace, with epidermoid plates, of a young example, 18 inches long. Sex and history unknown. Property of the Free Public Museum, Liverpool.

5. A living example, 15½ inches long, obtained by Captain E. M. Leeds (s.s. 'Tasmanian') at Colon, and presented by him to me. This will be deposited in the British Museum after its death.

Carapace.—In our largest example (specimen No. 1) (Plate 33. fig. A), which has been prepared into a skeleton, the outlines of the epidermoid plates can be clearly traced. It is a fully adult male, which, to judge from the condition of the bones, had ceased to grow a long time before its death; the dorsal portion of the shell is extremely

thin, in some parts quite transparent*. There is almost a total absence of anterior declivity of the first dorsal scute, its front margin being but very little below the level of the highest point of the carapace. The sides of this fore part of the carapace are expanded, not contracted as in *T. ephippium*. The caudal plate must have had a different shape from that of *T. nigrita*, being twice as wide as long (5 inches by $2\frac{1}{2}$ inches); however, these measurements are taken from the osseous base without the horny covering, which probably would have been somewhat longer. The *sternum* is $24\frac{1}{2}$ inches long, and 23 inches broad between the lateral margins of the abdominal plates. It is deeply concave, and when the animal rested on the ground, it touched it with the sides of the sternum, which are thicker than the remainder of the carapace, and on a transverse terminal callosity produced by the reverted posterior margin of the sternum, which is straight, truncated, without excision.

Another male example (specimen No. 3) agrees in every respect with the preceding, except in the sexual characters being much less developed, the specimen being only 23 inches long, and therefore much younger. The first dorsal scute is more declivous towards the front, the concavity of the sternum less deep, and its terminal callosity only indicated by the very porous and rough surface of the bone.

In our young example (18 inches long, specimen No. 4) the concentric striæ are numerous, but not deeply cut; and in this respect the present species is intermediate between *T. nigrita* and *T. ephippium*. The posterior end of the sternum is nearly truncate, the hind margin of each anal plate being obtusely rounded, and the plates being separated by so shallow a notch that, evidently, with advancing age, the sternum would have assumed the same truncate shape which we find in the adult specimens.

It remains to add the principal measurements of the specimens examined:—

		Length of carapace.		Width of carapace.		Sternum.		Caudal plate.	
		In str. line.	Over curv.	In str. line.	Over curv.	Length.	Width.	Length.	Width.
Spec. no.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1.	♂.....	31	$37\frac{1}{2}$	26	40	$24\frac{1}{2}$	23	$2\frac{1}{2}$†	5
2.	♀.....	$28\frac{1}{2}$	$36\frac{1}{2}$	23	35	$22\frac{1}{2}$	19		
3.	♂.....	23	$27\frac{1}{2}$	18	29	$18\frac{1}{2}$	$16\frac{1}{2}$	$1\frac{1}{2}$†	$3\frac{5}{8}$
4.	♀? ...	18	22	$12\frac{1}{2}$	$19\frac{3}{4}$	14	12	$1\frac{7}{8}$	3
5.	♀? ...	$15\frac{1}{2}$	$18\frac{1}{2}$	$11\frac{1}{2}$	19	$12\frac{1}{2}$	11	$1\frac{1}{2}$	$2\frac{3}{8}$

* Falconer, in his notes on *Colossochelys atlas* (Palæontolog. Mem. vol. i. p. 378), states that "the thickness of bone in the convexity is almost in an inverse ratio to the size. The physiological reason of this is, that the smaller the animal, the more liable it is to injury, and it requires a greater arch to sustain it." This view is not confirmed by an examination of the living Tortoises; the Aldabra species is as large as those from the Galapagos, and even larger than one of these latter, yet it has a much thicker shell. We shall see that the extinct Mascarene species agree with the Galapagos Tortoises in this respect. Perhaps the cause of this is to be sought in the small quantity of earthy matter contained in the food on which those animals chiefly subsist, viz. succulent cacti. A living Galapagos Tortoise in my possession prefers, at present, the petals of a *Westeria* to every other plant. Of course, by the thinness of the shell its weight is much reduced, and these Tortoises are therefore able to walk faster and to carry the shell higher above the ground than the other species of this genus. The thinness of the shell and the slender osseous framework of the limbs are, in fact, characters correlated to each other.

† Without epidermoid scutes.

Osteology.—In the preceding remarks, as well as in the following notes on the osteological characters of the various species, it is not my intention to give such a complete description as would include every detail common to all the species of *Testudo*; but I shall limit myself to those points only by which the various species of gigantic Tortoises differ from one another in a marked manner.

The *skull*, then, of our adult example of *Testudo elephantopus* (specimen No. 1, fig. A of Plates 37–39) is distinguished by a very short snout and a singularly raised occipital crest; it is $4\frac{5}{8}$ inches long, measured from the front margin of the intermaxillary to the occipital condyle, and 4 inches broad in its widest part, between the zygomatic arches. 1*. The frontal region is perfectly flat, broad, passing into the very short snout, its greatest width (in front of the postfrontals) being as much as one half of the distance between the tympanic condyles. 2. The occipital crest is enormously developed; it rises abruptly above the level of the skull, is strongly compressed and scarcely attenuated behind, its extremity being broad and rounded. 3. The tympanic case, with the mastoid, is produced backwards, the hind margin of the paroccipital forming a rather strong curve (fig. A, *a*). 4. A deep hollow on the lower surface of the occipital in front of the condyle (Plate 39. fig. A, *b*). 5. On the front margin of the temporal fossa, corresponding to the suture between parietal and tympanic, and immediately in front of the *foramen carotidis externæ*, there is a large, prominent, concave rough tuberosity for the insertion of a portion of the temporal muscle (Plate 37. fig. A, *c*); a broad and deep groove (*d*) separates this tuberosity from the zygomatic arch. 6†. Tympanic cavity large, but constricted by the groove just described; the outer tympanic rim is subcircular, with a broad and deep notch (*e*) in the posterior part of its circumference for the passage of the Eustachian tube. 7. The columella is attached to, and rests upon, a long, straight, sharp ridge, which runs from the notch mentioned to the stapedial foramen. 8. The posterior wall of the inner tympanic cavity, which, in fresh examples, is formed by cartilage, and an open space in the preserved skull after maceration, is but limited in extent, about one seventh of the area of the tympanic opening. 9. The front margin of the intermaxillary projects beyond that of the frontal, but much less than in the Mascarene Tortoise, so that the nasal opening, although still obliquely sloping downwards, is as high as broad. 10. The position of the choanæ is advanced forwards; yet, on the palatal view of the skull, a portion of them may be seen uncovered by the alveolar lamellæ of the maxillaries (Plate 39. fig. A). 11. The intermaxillaries are short,

* In this and the following descriptions of the skulls the same points are noticed under the same numbers, a plan by which the comparison of the several parts (sometimes described many pages apart) is much facilitated. The significance of certain modifications of structure noticed here will become more apparent when we shall treat of the skulls of the Mascarene Tortoises.

† It is very singular that although the osseous parts of the auditory organ are so well developed, nevertheless, according to the unanimous testimony of the observers, these Tortoises are absolutely deaf. I find this confirmed so far in my young living example that it never takes notice of the noisy approach of a person whom it cannot see, nor is it disturbed by the fall of a stone behind its back. Perhaps the faculty of hearing, although never acute, is not entirely lost until the individuals have attained to a great age.

one half of the length of the maxillaries; their foremost portion is deeply hollowed out below, and vertically bent downwards to form the truncated beak. The suture between the intermaxillary and vomer is immediately behind the inner angle of the alveolar edges of the maxillaries. 12. The palatal region is much less concave than in the Aldabra Tortoise, and divided along its middle by a high longitudinal crest. The triangular space of which the foramina palatina and the anterior extremity of the vomer form the points is nearly isoscelous in shape, in accordance with the generally short longitudinal axis of the skull. Outer pterygoid edge (*f*) rather elevated and sharp. 13. Anterior surface of the tympanic pedicle deeply excavated.

14. Lower jaw with a double alveolar ridge; its symphyseal portion simply vertical, without a backward expansion of the lower margin of the bone. The parts of the angular and coronoid which face each other are closely approximate, leaving only a narrow cleft between them. Upper margin of the angular deeply excised.

The *cervical portion of the vertebral column* is characterized by its relatively great length. All observers were struck by the length of the neck, which the animal is in the habit of erecting so that the head is raised above the level of the shell. A living animal now before me can turn its head in this position to the right or left, reminding one of a Cobra rising in a posture of defence. This slenderness of the neck is not due to an increase in the number of vertebræ (which is constant in Tortoises as in Mammals, and limited to eight), but to their elongated shape. In *T. elephantopus* they are not quite so slender as in *T. rodericensis*, but much more so than in the species from Aldabra. Also the spinal canal is narrower than in this latter round-headed form. The crests of the dorsal as well as visceral surface are well developed, and sometimes accompanied by low additional crests. All the articulary processes diverge comparatively but little, and those which in the Aldabra species are nearly perpendicular to the longitudinal axis of the vertebræ, are oblique and much depressed in *T. elephantopus*.

In the *atlas* (Plate 40. fig. A) the lateral portion of the neural arch (column) is very much constricted, not broader than the zygapophysis, which is elongate and considerably longer than that part of the bone which forms the roof of the arch. The centrum (odontoid process) (*a*) is a rhombohedral body.

In the *second* vertebra the neural arch is remarkably compressed and elevated, also provided with a high neural crest. The *third* has a condyle in front, and a glenoid cavity behind *. The *fourth* is biconvex. The *fifth* (Plate 40. fig. C) has a glenoid cavity in front and a condyle behind; its median neural crest is low, and accompanied on each side by two other crests which diverge in the direction of the posterior zygapophyses. The *sixth* (Plate 40. fig. D) has a glenoid cavity in front and a condyle behind; its dorsal surface is flat, without crest, whilst on its visceral surface a low crest is evenly continued along nearly the whole length of the vertebra. The *seventh* biconcave vertebra (Plate 41. fig. B) is distinguished by the high crest on its dorsal and visceral

* We shall see in the following part of this essay that these articulations of the cervical vertebræ are somewhat modified in the Aldabra species.

surface; in the middle of the vertebra the neural crest is split into two branches, diverging in the direction of the zygapophyses and leaving a deep triangular recess between them. The point of divergence forms a kind of summit (*a*) to this vertebra. The neural arch is deeply hollowed out (*b*) inwards of and behind each anterior zygapophysis to receive the zygapophysis of the preceding vertebra; but no perforation of the bone takes place as in the extinct species of Rodriguez. The *eighth* vertebra, with its bipartite anterior and single posterior condyle, and with its expanded hamate posterior zygapophysis, does not differ from that of the Aldabra species.

The measurements of the second to seventh cervical vertebræ are as follows:—

	2nd. millims.	3rd. millims.	4th. millims.	5th. millims.	6th. millims.	7th. millims.
Length of centrum	55	67	85	83	85	74
Depth of centrum in the middle . .	34	28	27	27	28	53
Horizontal width of middle of centrum	15	17	18	20	29	27
Width of anterior condyle	15	20	19	...	...	...
Width of anterior glenoid cavity . .	...	...	...	30	34	40
Width of posterior condyle	...	...	27	32	37	...
Width of posterior glenoid cavity . .	19	20	...	...	...	43
Distance of outer margins of anterior zygapophyses	23	34	35	38	40	38
Distance of outer margins of posterior zygapophyses	25	26	28	30	29	46

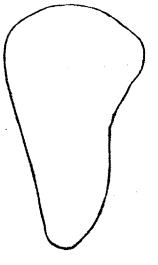
Of the *dorsal vertebræ* scarcely more than the measurements need to be noticed; these are of some importance in comparison with the corresponding vertebræ in other species and also with the cervical vertebræ. The two heads of the first rib are slender, much divergent, leaving a wide triangular space between them and the first dorsal vertebra. The iliac bones abut against the pleurapophyses of the 9th, 10th, 11th, and 12th vertebræ, counting from the first dorsal vertebra. Their distal extremities unite to form the protuberance for the articulation of the ilium.

Length of centrum of dorsal vertebræ:—

1st. mm.	2nd. mm.	3rd. mm.	4th. mm.	5th. mm.	6th. mm.	7th. mm.	8th. mm.	9th. mm.	10th. mm.	11th. mm.	12th. mm.
65	80	80	80	78	55	48	48	16	14	16	22

The number of *caudal vertebræ* I have found to be the same in both our skeletons, viz. twenty-three.

Limb-bones.—In the *scapulary* (Plate 44. figs. C, C′) we notice the very obtuse angle at which the scapula and acromium meet. The body of the scapula proper is rather slender, compressed, trihedral in form, with its anterior side convex, as shown in the annexed figure, which represents a transverse section through its middle. The coracoid is not anchylosed to the scapula. The measurements of this bone are the following:—



	millims.
Length of scapula (measured from the suture with the coracoid)	200
Circumference in its middle	75
Longitudinal diameter of glenoid cavity	50
Length of coracoid	86
Greatest width of coracoid	70
Length of acromium	84

The shaft of the *humerus* (Plate 42. figs. A, A′) is moderately slender, subtrihedral, with the edges well rounded off. There exists a deep impression on the outer side of the bone, immediately below the head and ulnar tuberosity (*a*), and another transverse impression on the hinder side above the trochlea. The ulnar tuberosity projects high above the head, which is nearly entirely raised above the level of the summit of the radial tuberosity. The canal (*b*) for the blood-vessels on the radial edge of the bone, close to the elbow-joint, is perfectly closed, perforating the substance of the bone from the front to the hinder side.

	millims.
Length of the humerus, measured in a straight line from the summit of the head to the middle of trochlea	216
Circumference of the narrowest part of the shaft	89
Longest diameter of the head	40
Shortest diameter of the head	37
Extreme breadth between the condyles	82

The bones of the *forearm* do not show any noteworthy peculiarity; but, for the sake of comparison with some of the following species, I give the measurements:—The ulna has a length of 137 millims., and a width of 28 millims. in its narrowest part; the radius a length of 121 millims., and a circumference of 50 millims., also measured in its narrowest part.

As in *Testudo* generally, so here the *carpal* bones (Plate 44. fig. D) are arranged in three series, of which the proximal consists of two bones, *lunare* and *cuneiforme*, both articulating with the end of the ulna (*u*); the middle of the transversely elongate *scaphoid* and "*intermedium*;" and the distal of five small rounded bones corresponding to, and articulating with, the five metacarpals. The scaphoid articulates with the end of the radius (*r*), the "intermedium" being intercalated between the lunare and third digit. However, in our old specimen of this species there exists the peculiarity that the scaphoid and intermedium are coalesced into a single very long bone (*a*), and that the two radial ossicles of the distal series are similarly united (*b*).

Pelvis (Plate 43).—In the first place must be noticed the considerable horizontal width of the symphyseal bridge (*a*) between the obturator foramina, by which the flat-headed Tortoises are so signally distinguished from the round-headed ones. But quite peculiar to this species is, first, that also the vertical diameter of this bridge is consi-

derable, and scarcely less than the horizontal; and, secondly, that, although all other sutures in this aged specimen have disappeared, the transverse suture between the pubic and ischiadic halves of the bridge is still persistent. The iliac bones are comparatively slender, the longitudinal diameter of the pelvis much exceeding the horizontal one. The lower part (*b*) of the pubic bones is gently inclined downwards and slightly concave above; it emits laterally a very long, strong, nearly styliform process (*c*), which is obliquely directed outwards. The posterior part (*d*) of the ossa ischii is of considerable width, very slightly concave above, and provided with a trenchant symphyseal crest below, which, expanding towards behind, forms a large triangular tuberosity. Lateral margin of the ossa ischii excised in the shape of a C. Obturator foramina of moderate width, considerably wider than the bridge between them, which is not provided above with a median longitudinal crest.

	millims.
Longest inner vertical diameter of pelvis (from summit of ilium to symphysis)	170
Longest inner horizontal diameter of pelvis	132
Shortest inner horizontal diameter of pelvis (between ilio-pubic prominences)	112
Longest diameter of foramen obturatorium	42
Width of symphyseal bridge	26
Depth of symphyseal bridge	26
Least breadth of posterior portion of ossa ischii	61
Length of os ilii	140
Least breadth of os ilii	30

The shaft of the *femur* (Plate 44. figs. A, A′, A″) is rather stout, nearly straight, irregularly subtetrahedral, narrower in front than behind. The head has an elliptical form, and does not rise above the level of the summit of the larger trochanter, from which it is separated by a deep and broad cavity. The larger (*a*) and lesser (*b*) trochanters are confluent into one broad ridge, and not separated from each other by a smooth groove, as we shall find to be the case in some of the following species. The length of the femur in this example is 169 millims., with a least circumference of 80 millims.; the width of the condyles is 66 millims.

Of the *lower leg* no part deserves to be mentioned particularly. The *tibia* is 136 millims. long, and the *fibula* 123 millims.

Also the bones of the *foot* may be passed over, with the exception of one point, viz. that, like some bones of the carpus, the astragalus and calcaneum are entirely coalesced, so that no trace of their former separation remains.

2. *Testudo nigrita.*

No doubt can possibly be entertained as regards the correct application of this name to the species which I am about to describe. It had been given by Duméril and

Bibron ('Erpétol. Génér.' ii. p. 80) to two examples, of which the smaller, very young one, is in the Paris Museum, whilst the larger, but also of young age*, is the property of the Royal College of Surgeons. Bibron's description is almost entirely drawn up from the latter specimen, which, therefore, must be regarded as the type. However, I suspect that the very young example which Duméril and Bibron have associated with this specimen should not be referred to this species, but possibly belongs to one of the Mascarene Tortoises. Bibron, in his description of its legs, omits all mention of the large scute in front of the elbow—a character which, as far as we know at present, is common to all Galapagos Tortoises, but is absent in the Mascarene species. Further, I am almost certain that the large skull described by Dr. Gray (Shield Rept. p. 6, pl. 34) under the name of *Testudo planiceps* belongs to the present species, for the following reasons:—1. There is that circumstantial evidence, that we are acquainted with the adult skulls of *T. elephantopus*, *T. ephippium*, and *T. microphyes*, but not with that of *T. nigrita*. The skulls of the three former species have been preserved, together with their carapaces, but the skull belonging to the shell of our single adult individual of *T. nigrita* is lost. As the skull named *T. planiceps* differs in a marked manner from all the others, we may reasonably suppose that it is that of the last-named species. 2. The British Museum possesses a skeleton of a young *T. nigrita*; and although the skull of this individual has the specific characters not well developed on account of its young age, it shows a greater resemblance, especially in its narrower snout, to the skull named *T. planiceps* than to any of the three others.

The materials available for the description of this species are the following:—

1. A carapace without sternum of a very large example, 41 inches in a straight line; it was purchased by the Trustees of the British Museum of the Manager of the former Surrey Zoological Gardens, who could not give any information as regards its history (Plate 33. fig. B).

2. A carapace 22 inches long†; type of *Testudo nigrita* (D. & B.); property of the Royal College of Surgeons; history and sex unknown. I am indebted to Prof. Flower, F.R.S., for the loan of this specimen (Plate 35. fig. C).

3. The perfect skeleton with epidermoid plates of a young example, the carapace being $15\frac{1}{2}$ inches long. History and sex unknown. In the British Museum.

4. A very young example, stuffed, in the British Museum; carapace $8\frac{1}{4}$ inches long. This specimen was purchased of a collector coming from Chile, and therefore without doubt came originally from the Galapagos Islands. A figure of it, somewhat reduced in size, has been given by Dr. Gray, under the name of *T. elephantopus*, in Proc. Zool. Soc. 1870, p. 706, pl. 41‡.

* Bibron considered it to be an adult example; and its relation to the Galapagos Tortoises appears to have escaped his notice entirely.

† Bibron gives 365 millims. as the length of this example, which is evidently a misprint for 565.

‡ An example of about the same age is rather indifferently figured in Sowerby and Lear's 'Tortoises, Turtles, and Terrapins,' where it is named *Testudo indica*.

5. A skull of a very large example, described and figured by Dr. GRAY as *T. planiceps* (*l. c.*).

The *carapace* of this species is well characterized by its broad, circular shape, great depth, and more especially by the numerous, deeply cut concentric striæ, by which the areolæ are much reduced in size in immature examples, and which are persistent in considerable number even in specimens of the largest size. Our largest example (specimen No. 1, Plate 33. fig. B) is a carapace 41 inches long, unfortunately without the sternum. Nevertheless we can safely affirm that this individual was a male, all observers agreeing in that the females do not attain to so large a size. It is only 8 inches longer than broad, and when measured over the curvature its transverse circumference even exceeds the longitudinal. The areolar portions of the dorsal and marginal plates are perfectly smooth and raised above the general outline of the shell, especially those of the former; but each plate has a broad margin deeply sculptured with concentric and parallel striæ, the outer striated margin of the marginal plates being even broader than the smooth areolar portion. The first dorsal scute and the anterior half of the second are declivous, the declivity of the former being still steeper than that of the latter.

A deep notch, nearly as deep as that between the two foremost marginal plates, exists between the first and second marginals; and also the posterior margin of the shell is scalloped. The length of the caudal plate is to its width as 11 : 14 ($5\frac{1}{2}$ inches long and 7 inches wide); its surface is plane, that is, its posterior margin is not bent either inwards or outwards. The general colour is a deep black, with a brownish tinge about the margins of the majority of the plates.

As in the preceding species, the shell is thin and light; in this specimen it is only 4 millims. thick in the middle of a costal plate. Specimens of the common *Testudo græca* only about 8 inches long have a carapace almost as thick as these gigantic Tortoises.

The second specimen (Plate 35. fig. C), which is 22 inches long and the type of *T. nigrita*, is young, and probably a male, inasmuch as the sternum shows a slight concavity, and the passage between the hind margins of the caudal and sternal plates is of inconsiderable width. As in specimen No. 3 ($15\frac{1}{2}$ inches long), the carapace is deeply sculptured all over, the smooth areolæ being very small. Its transverse circumference equals the longitudinal. The front margin, as well as the hind margin, is deeply notched, each notch corresponding to the suture between two marginal plates. The outer surface of the caudal plate is convex, the hind margin being curved inwards; its length is to its width as 3 : 4. The sternum terminates anteriorly in a thickened, rounded, double-headed transverse knob, with a slightly concave surface below; and posteriorly in a deep rectangular notch. The colour is the same as in the adult example.

Our very young example, which is only $8\frac{1}{4}$ inches long, and figured in Proc. Zool. Soc. *l. c.*, agrees in every respect with those of more advanced age, differing from young

examples of the same size of *T. ephippium* by the greater relative width of the carapace. The principal measurements of the specimens described, are as follows:—

Spec. no.	Length of carapace. In str. line. inches.	Length of carapace. Over curv. inches.	Width of carapace. In str. line. inches.	Width of carapace. Over curv. inches.	Sternum. Length. inches.	Sternum. Width. inches.	Caudal plate. Length. inches.	Caudal plate. Width. inches.
1. ♂	41	52	33	53	...	...	$5\frac{1}{2}$	7
2. ♂	22	27	16	27	$18\frac{1}{2}$	$15\frac{3}{4}$	3	4
3.	$15\frac{1}{2}$	$19\frac{1}{2}$	11	19	12	$9\frac{3}{4}$	$2\frac{3}{4}$	$1\frac{5}{8}$
4.	$8\frac{1}{4}$	$10\frac{1}{4}$	6	$10\frac{1}{2}$	$6\frac{3}{4}$	6	$1\frac{1}{4}$	1

The *skull* (Plates 37–39. fig. D) is distinguished by its comparatively longer facial portion, and by the much produced mastoid processes; it is (see also GRAY, Catal. Tort. 1855, 4to, tab. 34) $5\frac{1}{4}$ inches long, measured from the intermaxillary to the occipital condyle, and $4\frac{1}{2}$ inches broad at its widest part, viz. between the tympanic processes. 1. Its frontal region is flat, narrow, its greatest width being two sevenths of the distance of the tympanic condyles. 2. Only the foremost part of the parietals forms a flat surface, the remainder being compressed into an almost trenchant crest, passing into the long narrow occipital spine, which is scarcely raised above the level of the skull (Plate 38. fig. D). 3. *The tympanic case with the mastoid is produced far backwards*, so that the paroccipital margin appears as a deep semicircular excision (Plates 38 & 39. fig. D, *a*). 4. A very deep hollow on the lower surface of the occipital, in front of the condyle (*b*)*. 5. *On the front margin of the temporal fossa*, corresponding to the suture between parietal and tympanic, immediately in front of the foramen carotidis externæ, *there is a large, prominent, flat, rough tuberosity* (*c*) for the insertion of a portion of the temporal muscle; a broad, not very deep groove (*d*) separates this tuberosity from the zygomatic arch. 6. Tympanic cavity exceedingly large, especially its posterior portion, the entrance being somewhat narrowed by the groove just mentioned; the outer tympanic rim is a regular circle, with a shallow notch in its hinder circumference for the passage of the Eustachian tube. 7. This notch is very remote from the columellar foramen, and a sharp ridge runs the whole distance from the notch to the foramen, serving as a rest for the auditory ossicle. 8. The posterior wall of the inner tympanic cavity, which in fresh examples is formed by cartilage and an open space in the preserved skull, is of but small extent, only about one eighth of the tympanic opening. 9. The front margin of the intermaxillaries projects beyond that of the frontals, but much less so than in the Mascarene Tortoises, so that the nasal opening, although still obliquely sloping downwards, is scarcely higher than broad. 10. The inner nostrils are advanced, not very distant from the end of the snout, and on the palatal view of the skull are nearly entirely hidden below the alveolar lamella of the maxillaries. 11. The intermaxillaries are short, not quite one half of the length of the maxillaries, and their foremost portion is deeply hollowed out below, and verti-

* In the figure given by Dr. GRAY the artist has entirely omitted to express the depth of this hollow by shading.

cally bent downwards to form the truncated beak. The suture between the intermaxillary and vomer is immediately behind the inner angle of the alveolar edges of the maxillaries. 12. Palatal region much less concave than in the Mascarene Tortoises, and provided with a rather high median longitudinal crest; posteriorly it is bordered on each side by the raised pterygoid edge, which is obtuse in its anterior, and trenchant in its posterior half. The distance between the foramina palatina is much less than their distance from the anterior extremity of the vomer. 13. Anterior surface of the tympanic pedicle deeply excavated. 14. Lower jaw with a double alveolar ridge, the symphyseal portion being simply vertical, without a backward dilatation of the lower margin of the bone. The opposite surfaces of the angular and coronoid are closely approximate, leaving only a narrow cleft between them. Upper margin of the angular moderately excised.

The skull of our *young* example is only $2\frac{5}{12}$ inches long; it shows some of the characteristics described in the adult skull, viz. the greater depth and the less width of the palatal region, the deep hollow in front of the tympanic pedicle, and the conformation of the anterior half of the tympanic cavity. The groove between the temporal tubercle and zygomatic arch, as well as the hollow in front of the occipital condyle, are clearly indicated. On the other hand, the tympanic pedicles are less distant from each other than in the adult, the mastoido-tympanic process is only slightly produced backwards, and the occipital crest is short and much less prominent—points of difference which can be accounted for by the young age of the individual.

The description of the skeleton of so young an individual could hardly be accompanied by important results as regards the object of this paper, and is therefore omitted.

Caudal vertebræ 24.

3. *Testudo ephippium.*

I propose this name for a species equally well characterized by the peculiar form of its carapace and of its skull. Porter's remarks on the Tortoises of Charles Island (see *antè*, p. 256) apply so well to this species that I have no doubt that the specimen from which the following description is taken came from that island. If this is really the case, this species is extinct. The specimen is an adult male, 33 inches long, stuffed, and belongs to the Museum of Science and Arts, Edinburgh. It was lent to me by T. C. Archer, Esq., Director of the Museum of Science and Art, Edinburgh, who most kindly allowed the skull and limb-bones to be extracted, which could be effected without the least injury to the outward appearance of the specimen. Nothing is known of its history.

A very young stuffed example, 7 inches long, in the British Museum is referred to this species on account of its oblong shape and large smooth areolæ.

The *carapace* (Plates 34 & 35. fig. B) is narrow, oblong, and deep; from the middle of the central dorsal plate to the front margin of the shell the upper profile is nearly

horizontal, the fore part of the shell being strongly compressed, concave on each side, with the anterior margin strongly reverted—this part of the shell having an appearance which has been so aptly compared by PORTER with a "Spanish saddle." The hind part of the shell is rounded, with a steep posterior profile, but more gently declivous on the sides, the marginal plates above the hind legs being arched outwards with the edge somewhat reverted, but less so than on the anterior marginal plates. The anterior as well as the posterior margins are irregularly scalloped. The plates are nearly smooth, the areolar portions passing gradually into the striated portions; but the striæ themselves are inconspicuous, and in many places nearly obliterated. The sternum* is deeply concave, truncated in front and behind, the substance of the caudal plates and of the lateral portion of the abdominals being much thickened.

I need not mention the scutellation of the head and legs, none of the Galapagos Tortoises showing any peculiarity in this respect. The tail is very short, and without terminal "claw."

On comparing the carapace of the young example with that of equally small specimens of other species, we find the areolar spaces larger, the concentric striæ deeply sculptured, but less numerous and further apart. Especially the sternal plates are smooth, with the striæ partly obliterated. Posteriorly the sternum terminates in a notch (and this appears to be uniformly the case in very young specimens of all the species); but this notch is much shallower than in *T. nigrita*, obtuse-angular.

The measurements of these two specimens are the following:—

	Length of carapace.		Width of carapace.		Depth of	Sternum.		Caudal plate.	
Spec.	In str. line. inches.	Over curv. inches.	In str. line. inches.	Over curv. inches.	carapace. inches.	Length. inches.	Width. inches.	Length. inches.	Width. inches.
Adult .	33	40	23½	40	17	24	21½	3½	6
Young .	7	9⅛	5	8½	3½	4¾	6¾	1	1¼

Skull.—The skull (Plates 37–39. fig. C) is comparatively smaller than that of *T. elephantopus*; it is 4⅝ inches long, measured from the front margin of the intermaxillary to the occipital condyle, and 3¾ inches broad in its widest part between the zygomatic arches. The sutures between the various bones can be clearly traced; and growth evidently had not ceased entirely, an observation confirmed by the examination of other bones extracted from the specimen. 1. The frontal region is flat, broad, passing into the very short snout, its greatest width (in front of the postfrontals) being about one half of the distance between the tympanic condyles. 2. The occipital crest is moderately developed, pointed behind, and rising but little above the level of the upper surface of the skull. 3. The tympanic case with the mastoid is produced backwards, the hind margin of the paroccipital forming a rather strong curve (Plate 37. fig. A, *a*). 4. There is no hollow in front of the occipital condyle; the space between the condyle

* A large portion in the middle of the sternum has been cut out by the person who preserved the animal, in order to extract the contents of the shell.

and basisphenoid simply shelving downwards towards the latter (*b*). 5. On the front margin of the temporal fossa, in front of the *foramen carotidis externæ*, there is a large not very prominent tuberosity (*c*) for the insertion of a portion of the temporal muscle; no groove separates this tuberosity from the zygomatic arch; or, in other words, the tympanic cavity is not constricted in front. 6. Tympanic cavity very large: the outer tympanic rim ovate, resembling the outline of the human concha, with the convex side in front, and the pointed part above; the notch for the passage of the Eustachian tube is very broad, but shallow (*e*). 7. The ridge which runs from this notch to the stapedial foramen, and to which the columella is attached, is rather low and obtuse. 8–11. The points noticed under these figures in the description of the skull of *T. elephantopus* (see page 263) are exactly the same in the present species. 12. The palatal region is very shallow and broad, in consequence of the outer pterygoid edge being flattened down and expanded in its whole length (Plate 39. fig. C, *f*). The triangular space, of which the foramina palatina and the anterior extremity of the vomer form the points, is isoscelous in shape, in accordance with the generally short longitudinal axis of the skull. 13. Anterior surface of the tympanic pedicle with a shallow impression. 14. Lower jaw with a double alveolar ridge; its symphyseal portion simply vertical, without a backward expansion of the lower margin of the bone. The parts of the angular and coronoid which face each other leave a rather wide cleft between them. Upper margin of the angular not excised.

Limb-bones.—The following bones have been preserved in our large stuffed example, and were extracted from it:—The *humerus* (Plate 42. figs. B, B′), distinguished by its great length and slenderness; its shaft is trihedral in the middle, and not much bent. The two hollows which we noticed in *T. elephantopus* below the head and above the trochlea are here absent. The ulnar tuberosity (*a*) projects high above the head, which is nearly entirely raised above the level of the summit of the radial tuberosity. The canal (*b*) for the blood-vessels on the radial edge, close to the elbow-joint, is deep and partly open, cutting off, as it were, a splint from the radial extremity of the bone.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.
Length of the humerus, measured in a straight line from the summit of the head to the middle of trochlea	216	235
Circumference of the narrowest part of the shaft .	89	91
Longest diameter of the head	40	40
Shortest diameter of the head	37	35
Extreme breadth between the condyles	82	82

The bones of the *forearm* (Plate 45. fig. B) are, like the humerus, comparatively slender; they are remarkably smooth, without prominent ridges or tuberosities. The ulna has its radial edge but slightly emarginate, and is twisted round its longitudinal

axis, so that the transverse diameters of its proximal and distal dilatations would intersect each other at an angle of about 50°. The olecranon is not much developed. The articulary facet of the radius for the articulation with the humerus is a rectangular triangle, with the point directed backwards, and the shortest side in front.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.
Length of ulna	137	155
Least width of ulna	28	26
Length of radius	121	149
Least circumference of radius	50	51

Only a few of the *carpal* bones have been extracted from the specimen, among them the scaphoid and "intermedium," which have remained perfectly separate.

In the *pelvis* (Plate 45. fig. A) we notice, in the first place, that all the sutures are present, and that growth was still proceeding in their vicinity. However, on the whole, the pelvis does not differ in a marked manner from that of *T. elephantopus*, except that the symphyseal bridge is broader (the obturator foramina, consequently, narrower) and not so deep. The posterior part of the ossa ilii also is broader than in the other species. Other slight differences of form may be seen from the accompanying comparative measurements:—

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.
Longest inner vertical diameter of pelvis (from summit of ilium to symphysis)	170	160
Longest inner horizontal diameter of pelvis	132	118
Shortest inner horizontal diameter of pelvis (between ilio-pubic prominences)	112	97
Longest diameter of foramen obturatorium	42	42
Width of symphyseal bridge	26	35
Depth of symphyseal bridge	26	23
Least breadth of posterior portion of ossa ischii	61	80
Length of os ilii	140	130
Least breadth of os ilii	30	27

The *femur* is very similar to that of *T. elephantopus* (p. 267), with the exception of its proximal portion (Plate 44. fig. B): the head has an elliptical form, and does not rise above the level of the summit of the larger trochanter, as in *T. elephantopus*, but is considerably smaller; on the other hand, the cavity separating the head from the trochanters is much larger, as broad as long, and the two trochanters (*a* and *b*) are widely separated from each other by a smooth groove.

The bones of the *lower leg* and *carpus* do not show any noteworthy peculiarity: as in

T. elephantopus, the astragalus and calcaneum are coalesced, but, owing to the less advanced age, the line of separation is still visible.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.
Length of the femur	169	186
Least circumference of the femur	80	90
Longest diameter of head of femur	55	43
Width of the condyles	66	67
Length of the tibia	136	150
Least circumference of the tibia	60	72
Length of the fibula	123	138
Least circumference of the fibula	45	45

4. *Testudo microphyes*.

This is the smallest of the Galapagos Tortoises, a fully adult male being only $22\frac{1}{2}$ inches long. As PORTER states that "the Tortoises of Hood's Island were small, similar to those of Charles Island," I suppose that the specimen which I propose to describe under the above name has come from Hood's Island. It is a fully adult male, stuffed, with a carapace $22\frac{1}{2}$ inches long, and belongs to the Royal Institution of Liverpool. I am indebted to the Museum-Committee of the Institution not only for having sent to me the specimen on loan, but also for having permitted the skull to be extracted for comparison with the other species.

The *carapace* (Plate 36) is very regularly shaped, its outline being a regular oval, with scarcely a trace of notches between the marginal plates; it is depressed. There is no, or only a very slight, nuchal excision, and the fore part of the shell is declivous from the centre of the second dorsal plate. The caudal and the two adjoining marginals are slightly concave, this part of the shell being somewhat arched outwards. The plates of the back, as well as sternum, are perfectly smooth, without a trace of concentric striæ*; the sternum is deeply concave, truncated in front and behind. As an (probably) individual peculiarity, must be noticed the confluence of the two anterior marginals into one plate on each side. The tail, as in the other Galapagos Tortoises, is short, without terminal claw. Although it is impossible in these stuffed specimens to state in precise terms the length of the neck, yet, from the manner in which the skin had been stretched by the taxidermist in our specimen, it is evident that the neck must have been conspicuously shorter in this species than in the others.

The measurements are as follows:—

	Length of carapace.		Width of carapace.		Depth	Sternum.		Caudal plate.	
	In str. line.	Over curv.	In str. line.	Over curv.	of carap.	Length.	Width.	Length.	Width.
Spec.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
Ad. ♂	$22\frac{1}{2}$	26	$15\frac{1}{2}$	29	10	18	14	2	$3\frac{3}{8}$

* Also DUMÉRIL and BIBRON (*l. c.* p. 117) describe an entirely smooth specimen, which they refer to *T. nigra* (Q. & G.); but they mention that the sternum of that specimen had a triangular excision behind.

Skull.—The skull of the adult male (Plates 37–39. fig. B) is $3\frac{1}{4}$ inches long, measured from the intermaxillary to the occipital condyle, and $2\frac{7}{12}$ inches broad in its widest part, viz. between the zygomatic arches. In general appearance it has a great resemblance to the skulls of young examples of the larger species; yet nearly all the sutures have disappeared, so that the example is evidently a fully adult individual. It is thus another instance of a well-known fact, viz. that often small species retain through life the juvenile characters of their larger and more fully developed congeners. The skull is conspicuously more similar to that of *T. ephippium* than to those of the first two species, as will be seen from the following notes:—1. The frontal region is flat, very broad, passing into the very short snout, its greatest width (in front of the postfrontals) being rather more than one half of the distance between the tympanic condyles. 2. The occipital crest is comparatively short, pointed behind, and scarcely rising above the level of the surface of the skull. 3. The tympanic case, with the mastoid, is but little produced backwards, the hind margin of the paroccipital (*a*) being nearly straight. 4. There is no hollow in front of the occipital condyle, the space (*b*) between the condyle and basisphenoid gently shelving downwards towards the latter. 5. On the front margin of the temporal fossa, in front of the *foramen carotidis externæ*, there is a broad concave prominence (*c*) for the insertion of a portion of the temporal muscle; no groove separates this prominence from the zygomatic arch; or, in other words, the tympanic cavity is not constricted in front. 6. Tympanic cavity of moderate size, the posterior portion being particularly small: the outer tympanic ring is subcircular; the notch (*e*) for the passage of the Eustachian tube rather narrow, but deep. 7. The ridge which runs from this notch to the stapedial foramen, and to which the columella is attached, is rather low and trenchant. 8–11. The points noticed under these numbers in the descriptions of the skulls of *T. elephantopus* (p. 263) and *T. ephippium* (p. 273) are exactly the same in the present species. 12. The palatal region is moderately shallow and not very broad, but the outer pterygoid edge is expanded as in *T. ephippium*. The distance between the foramina palatina is conspicuously less than that between one of these foramina and the anterior extremity of the vomer. 13. Anterior surface of the tympanic pedicle with a deep impression. 14. Lower jaw with a double alveolar ridge; its symphyseal portion is simply vertical, without a backward expansion of the lower margin of the bone. The parts of the angular and coronoid which face each other are closely approximate. Upper margin of the angular not excised*.

* With regard to the skull of a very young example in the British Museum, I still hesitate to refer it to this species. There cannot be any doubt that it belongs either to *T. ephippium* or to *T. microphyes*, having the pterygoid edge expanded in the manner by which those two species are so well characterized. But the occipital spine is more produced backwards than I should have expected to find it in the young of *T. microphyes*, the adult of which has this process comparatively short. However, the outer tympanic rim has exactly the subsemicircular shape of that species, and not the ovate outline of *T. ephippium*.

5. *Testudo vicina.*

A few days after the preceding notes had been delivered to the Royal Society (see Proc. Roy. Soc. 1874, June 18th) I received, through the kindness of Professor HUXLEY, Sec. R.S., the carapace and skeleton of another adult male example, which on closer inspection proved to be a highly interesting addition to our knowledge of these Tortoises. Unfortunately no record of its history has been preserved; but the condition of the bones, which have retained a large quantity of fat, clearly shows that the animal had been living within a very recent period, and therefore came from the Galapagos, and not from one of the Mascarene islands *.

The form of the carapace (Plate 35. fig. A) reminds us of that of *T. elephantopus*, but it is still more depressed, the greater part of the two middle costal plates participating in the formation of the plane surface of the back. The first dorsal scute is but very slightly declivous towards the front, and the edge of the shell along the three anterior marginals is reverted and scalloped; thus the fore part of the shell has in a slight degree the form of a saddle, but it is much less compressed than in *T. ephippium*. The striæ of the plates are very distinct, but shallow, and distant from one another (broad), occupying the greater part of the surface of each plate. The striated portions of the plates are not of the same intense black as the smooth ones, but more or less tinged with brown. The shape of the *sternum* differs from that of the preceding species, its gular portion being singularly constricted and having the lateral margins excised. The gular plates are truncated in front. The opposite end of the sternum is dilated, the caudal plates being expanded like wings; their hind margins meet at an obtuse angle. All the plates of the sternum, with the exception of the pectorals and abdominals, are striated like the dorsal plates. The surface of the sternum is deeply concave.

There is in the British Museum a young stuffed example, with a carapace $12\frac{1}{3}$ inches long (without particular indication of its origin), which I am inclined to refer to this species. It has the same depressed shell as the adult, with a similar striation of the plates, and with the anterior margins distinctly reverted; but the sternum is not constricted anteriorly, nor are the caudals expanded like wings. At present we have not the means of judging whether this difference could be accounted for by age or sex; however, as the skull of this young individual agrees singularly well with that of the adult, there is good reason for believing it to be a second example of the same species.

* My endeavours to trace in the various Collections the specimens which are known to have reached England alive within the last forty years have been hitherto singularly unsuccessful; and the present example is the only one which might be supposed to be possibly identical with the individual reported to have been sent to the Zoological Society in 1834, by the Hon. BYRON CARY, from the Galapagos (Proc. Zool. Soc. 1834, p. 113). That specimen is said to have weighed 187 lbs., and measured in length, over the curve of the dorsal shell, $44\frac{1}{2}$ inches (I find in our specimen $41\frac{1}{2}$ inches), and along the sternum $25\frac{1}{2}$ inches (as in ours); its girth round the middle was $75\frac{1}{2}$ inches (69 inches according to my measurement). It is added that "the lateral compression of the anterior part of the dorsal shell, and the elevation of its front margin .... are in this specimen strongly marked."

The measurements of the two specimens are as follows:—

Spec.	Length of carapace. In str. line. inches.	Over curv. inches.	Width of carapace. In str. line. inches.	Over curv. inches.	Depth of carap. inches.	Sternum. Length. inches.	Width. inches.	Caudal plate. Length. inches.	Width. inches.
Ad. ♂	33	41½	25	42	16	25½	24	4¼	6½
Young . . .	12⅓	14½	9	14½	5½	10½	8½	1⅛	2⅛

Skull.—The skull* is 4⅞ inches long, measured from the front margin of the intermaxillary to the occipital condyle, and 4 inches broad in its widest part, between the zygomatic arches; therefore it is comparatively larger than that of *T. ephippium*. The sutures between the various bones can still be traced; and from the condition of the rest of the skeleton it is evident that growth had not entirely ceased in this specimen. The skull is extremely similar to that of *T. ephippium*; so that the skulls alone, without the evidence gained from other parts of the skeleton, would hardly afford sufficient grounds for specific separation. The points in which the two skulls differ are the following only:—(6) The outer tympanic rim of *T. vicina* (Plate 41. fig. A) has a subcircular outline, and (7) the ridge which runs from the Eustachian notch (*e*) to the stapedial foramen, and to which the columella is attached, is high and rather sharp. (13) The impression in front of the tympanic pedicle is much deeper than in *T. ephippium*.

The skull of our young example is only 2 inches long, and agrees in every respect with the adult, except that the parietal crest is less compressed and the tympanic case less produced backwards, as in all skulls of the young of these Tortoises.

Cervical vertebræ.—On comparing the neck-vertebræ of *T. vicina* with those of *T. elephantopus*, we find them generally to be somewhat less slender, and with the crests and ridges less developed; otherwise they are formed according to the same type, and the first, seventh, and eighth are the only vertebræ which exhibit peculiarities indicative of specific distinctness. In the *atlas* (Plate 40. fig. B) the lateral portion of the neural arch is but little constricted, at least as wide as the broad zygapophysis, which is longer than that part of the bone which forms the roof of the neural arch. In the *seventh* vertebra (Plate 41. fig. C) the summit (*a*) of the neural crest is not single as in the other species, but split into two prominences, separated from each other by a deep notch. In the *eighth* vertebra the hæmal crest is produced forward to the level of the anterior articulary surface, and almost hamate in form, whilst it does not extend beyond the middle third of the length of the centrum in *T. elephantopus*.

* A reduced figure of this skull is given in Huxley's 'Elementary Atlas of Comparative Osteology,' pl. 3, but, owing to the elementary object of that work, the details of the specific characters to which attention is drawn in this paper are not sufficiently well expressed; indeed it would be impossible to render some of them conspicuous in a figure reduced in size.

Measurements of cervical vertebræ:—

	2nd. millims.	3rd. millims.	4th. millims.	5th. millims.	6th. millims.	7th. millims.
Length of centrum	47	65	88	80	82	72
Depth of middle of centrum	34	26	25	26	25	49
Horizontal width of middle of centrum	14	18	17	20	25	27
Width of anterior condyle	15	18	20	...	...	...
Width of anterior articular cavity . .	...	...	...	36	42	41
Width of posterior condyle	...	...	25	28	39	...
Width of posterior articular cavity . .	19	23	...	...	...	50
Distance of outer margins of anterior zygapophyses	20	33	38	37	42	33
Distance of outer margins of posterior zygapophyses	28	31	31	35	28	55

Dorsal vertebræ.—The last of the three vertebræ which emit pleurapophyses to form the protuberance for the articulation of the ilium is the eleventh, so that only eleven vertebræ can be assigned to this part of the vertebral column. Of the two heads into which the first rib bifurcates the posterior is more slender than the anterior; the triangular space enclosed by them is wide, but less so than in *T. elephantopus*. For comparison with the latter species I give the length of the centra of the several dorsal vertebræ:—

Dorsal vertebræ	1st. mm.	2nd. mm.	3rd. mm.	4th. mm.	5th. mm.	6th. mm.	7th. mm.	8th. mm.	9th. mm.	10th. mm.	11th. mm.	12th. mm.
Test. elephantopus .	65	80	80	80	78	55	48	48	16	14	16	22
Test. vicina . . .	56	80	87	87	79	61	43	32	17	15	18	(21)

Caudal vertebræ twenty in number, but it is possible that the last rudimentary ossicle has been lost.

Limb-bones.—Singularly enough the resemblance which we notice between the skulls of this species and *T. ephippium* does not uniformly extend to the other parts of the skeleton, the limb-bones of *T. vicina* being much shorter and stouter than in that species, approaching more *T. elephantopus*. The *scapulary* (Plate 45. figs. C, C′) especially is stout and massive. The angle at which the scapula and acromium meet is much less obtuse than in *T. elephantopus* (about 100°); the body of the scapula is compressed, elliptical, with both its anterior and posterior sides equally convex; a transverse section through its middle would be represented by the figure of a greatly elongate O. The shaft of the acromium is trihedral, with the edges rounded, and with the extremity compressed and slightly dilated. The *coracoid* is not anchylosed to the scapula, and its proximal part (neck) is singularly dilated, and very much broader than the corresponding part in *T. elephantopus*. In fact the differences in the scapularies of

these two species are so great, that they alone would clearly prove their specific distinctness.

	T. elephantopus, 790 millims. long. millims.	*T. vicina*, 840 millims. long. millims.
Length of scapula (measured from the coracoid suture)	200	188
Circumference in the middle of the shaft	75	75
Longitudinal diameter of glenoid cavity	50	55
Length of coracoid	86	83
Greatest width of coracoid	70	74
Least width of neck of coracoid	20	33
Length of acromium	84	78

The *humerus* is so similar to that of *T. elephantopus* (and consequently very dissimilar to that of *T. ephippium*) that no detailed description is needed; but, as in the latter species, the canal for the blood-vessels on the radial edge, close to the elbow-joint, is deep and partly open.

	T. elephantopus. millims.	*T. ephippium*. millims.	*T. vicina*. millims.
Length of humerus	216	235	225
Circumference of the narrowest part of the shaft	89	91	95
Longest diameter of the head	40	40	40
Shortest diameter of the head	37	35	38
Extreme breadth between the condyles	82	82	81

The bones of the *forearm* (Plate 45. fig. D) are also shorter than those of *T. ephippium*, more similar to those of *T. elephantopus*, particularly with regard to the deeply emarginate radial edge of the *ulna*. Both bones are smooth, without prominent ridges or tuberosities. The ulna is twisted round its longitudinal axis, so that the transverse diameters of its proximal and distal dilatations would intersect each other at an angle of about 45°. The olecranon is not much developed. The articulary facet of the radius for the articulation with the humerus is a rectangular triangle, with the point directed backwards, and the shortest side in front.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.	*T. vicina*, 840 millims. long. millims.
Length of ulna	137	155	137
Least width of ulna	28	26	26
Length of radius	121	149	122
Least circumference of radius	50	51	49

Carpus.—The coalescence of the scaphoid and intermedium, and of the two radial ossicles of the third series, which we have found complete in *T. elephantopus*, has commenced in the present individual, but the lines of separation are still clearly visible.

The *pelvis* differs from that of *T. elephantopus* in the same manner as does that of *T. ephippium*, but its horizontal diameter is comparatively greater than in either of those two species. All the sutures are present.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.	*T. vicina*, 840 millims. long. millims.
Longest inner vertical diameter of pelvis	170	160	157
Longest inner horizontal diameter of pelvis	132	118	144
Shortest inner horizontal diameter of pelvis	112	97	97
Longest diameter of foramen obturatorium	42	42	38
Width of symphyseal bridge	26	35	41
Depth of symphyseal bridge	26	23	26
Least breadth of posterior portion of ossa ischii	61	80	76
Length of os ilii	140	130	134
Least breadth of os ilii	30	27	29

The *femur* agrees nearly entirely with that of *T. elephantopus*, thus differing from that of *T. ephippium* in the same points which have been indicated in the description of the latter species. The bones of the *lower leg* and *carpus* do not show any noteworthy peculiarity, the state of coalescence of the astragalus and calcaneum being the same as in some of the carpal bones mentioned above.

	T. elephantopus, 790 millims. long. millims.	*T. ephippium*, 840 millims. long. millims.	*T. vicina*, 840 millims. long. millims.
Length of the femur	169	186	165
Least circumference of the femur	80	90	79
Width of the condyles	66	67	73
Length of the tibia	136	150	129
Least circumference of the tibia	60	72	57
Length of the fibula	123	138	123
Least circumference of the fibula	45	45	43

Explanation of the Plates.

PLATE 33.

Fig. A. Three views of carapace of *Testudo elephantopus*; specimen in the Oxford Museum; $\frac{1}{6}$ the natural size.

Fig. B. Three views of carapace of *Testudo nigrita*; specimen in the British Museum; $\frac{1}{6}$ the natural size.

PLATE 34.

Testudo ephippium, from the typical specimen in the Museum of Science and Arts, Edinburgh; $\frac{1}{6}$ the natural size.

PLATE 35.

Fig. A. Three views of *Testudo vicina*, from the typical specimen in the British Museum.

Fig. B. Lower view of the carapace of *Testudo ephippium*.

Fig. C. Three views of *Testudo nigrita* juv., from the typical specimen in the Collection of the Royal College of Surgeons.

All these figures are $\frac{1}{6}$ of the natural size.

PLATE 36.

Testudo microphyes, from the Museum of the Philosophical Institution of Liverpool; $\frac{1}{4}$ the natural size.

PLATE 37.

Upper views of the natural size of the skulls of:—

Fig. A. *Testudo elephantopus*.

Fig. B. *Testudo microphyes*.

Fig. C. *Testudo ephippium*.

Fig. D. *Testudo nigrita*.

a. Posterior margin of paroccipital.

c. Tuberosity for the insertion of a portion of the temporal muscle.

d. Groove separating the tuberosity from the zygomatic arch.

PLATE 38.

Lateral views of the natural size of the skulls of:—

Fig. A. *Testudo elephantopus*.

Fig. B. *Testudo microphyes*.

Fig. C. *Testudo ephippium*.

Fig. D. *Testudo nigrita*.

e. Notch for the passage of the Eustachian tube.

PLATE 39.

Lower views of the natural size of the skulls of:—

Fig. A. *Testudo elephantopus.*

Fig. B. *Testudo microphyes.*

Fig. C. *Testudo ephippium.*

Fig. D. *Testudo nigrita.*

a, *c*, *d*, *e* as in Plates 37 & 38.

b. Hollow in front of occipital condyle.

f. Outer pterygoid edge.

PLATE 40.

Fig. A. Upper and lateral views of the atlas of *Testudo elephantopus.*

a. Centrum.

Fig. B. Upper and lateral views of the atlas of *Testudo vicina* (centrum lost).

Fig. C. Three views of the fifth cervical vertebra of *Testudo elephantopus.*

Fig. D. Three views of the sixth cervical vertebra of *Testudo elephantopus.*

All the figures are of the natural size.

PLATE 41.

Fig. A. Tympanic region of *Testudo vicina.*

e. Notch for the passage of the Eustachian tube.

Fig. B. Three views of the seventh cervical vertebra of *Testudo elephantopus.*

a. Summit of neural crest.

b. Hollow behind the anterior zygapophysis.

Fig. C. Three views of the seventh cervical vertebra of *Testudo vicina.*

a. Bifurcate summit of the neural crest.

All these figures are of the natural size.

PLATE 42.

Fig. A. Front view of the *humerus* of *Testudo elephantopus.*

Fig. A′. Back view of the same.

Fig. B. Front view of the *humerus* of *Testudo ephippium.*

Fig. B′. Back view of the same.

a. Ulnar tuberosity.

b. Radial canal for blood-vessels.

These figures are two thirds of the natural size.

PLATE 43.

Three views, of two thirds of the natural size, of the *pelvis* of *Testudo elephantopus*.

Fig. A. Front view.

Fig. B. Side view.

Fig. C. Top view.

a. Symphyseal bridge between the obturator foramina.

b. Lower portion of the pubic bones.

c. Styliform process of the pubic bones.

d. Posterior part of the ossa ischii.

PLATE 44.

Figs. A, A′. Front and side views of the *femur* of *Testudo elephantopus*.

Fig. A″. Top view of the same.

a & *b*. The confluent larger and lesser trochanters.

Fig. B. Top view of the femur of *Testudo ephippium*.

a. Larger trochanter separated by a wide groove from

b. Lesser trochanter.

Fig. C. Scapulary of *Testudo elephantopus*.

Fig. C′. Another view of the upper portion, to show the relative position of the coracoid and acromium.

Fig. D. Carpus of *Testudo elephantopus*.

u. Ulna.

r. Radius.

a. Coalesced scaphoid and os intermedium.

b. Coalesced two radial ossicles of distal carpal series.

All these figures are two thirds of the natural size.

PLATE 45.

Fig. A. Top view of the *pelvis* of *Testudo ephippium*.

Fig. B. Forearm of *Testudo ephippium*.

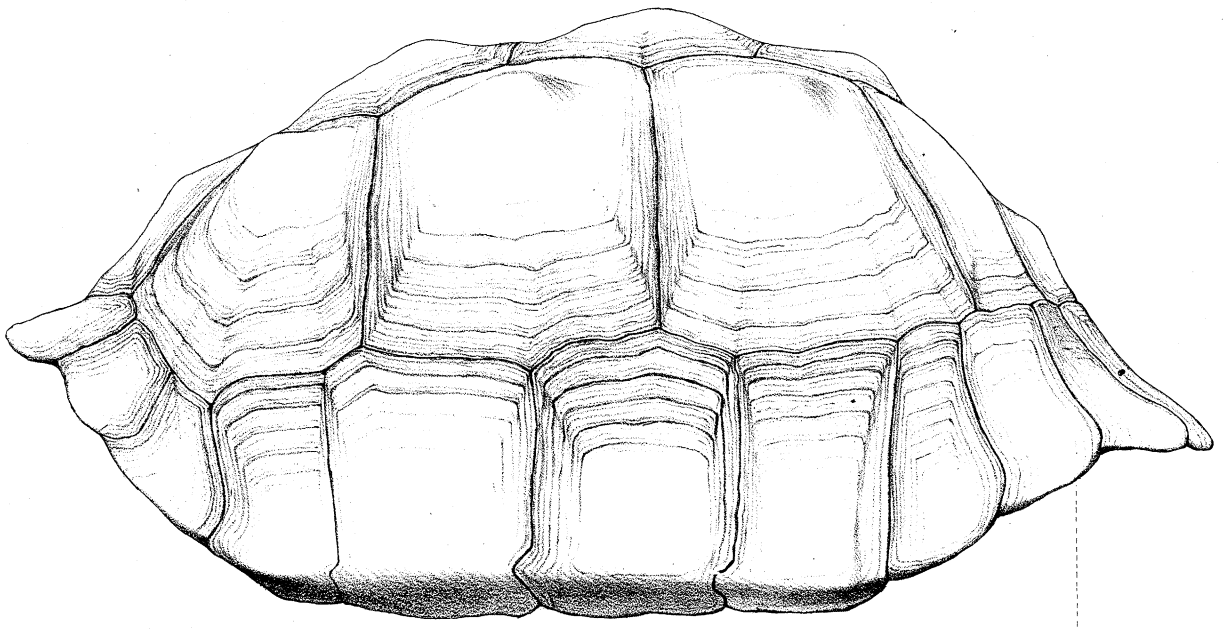
u. Ulna. *r*. Radius.

Fig. C. Scapulary of *Testudo vicina*.

Fig. C′. Another view of the upper portion, to show the relative positions of the coracoid and acromium.

Fig. D. Forearm of *Testudo vicina*.

u. Ulna. *r*. Radius.



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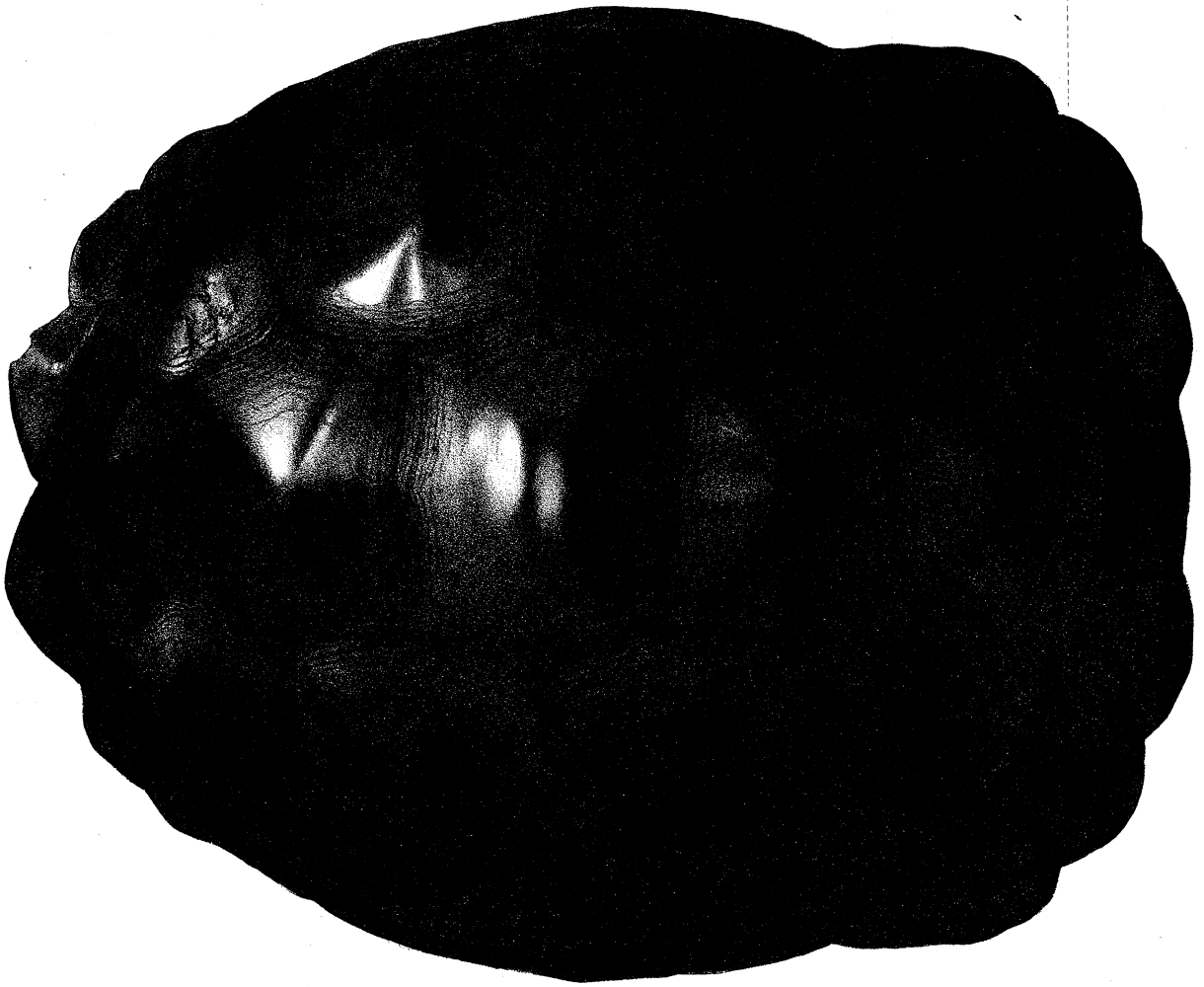

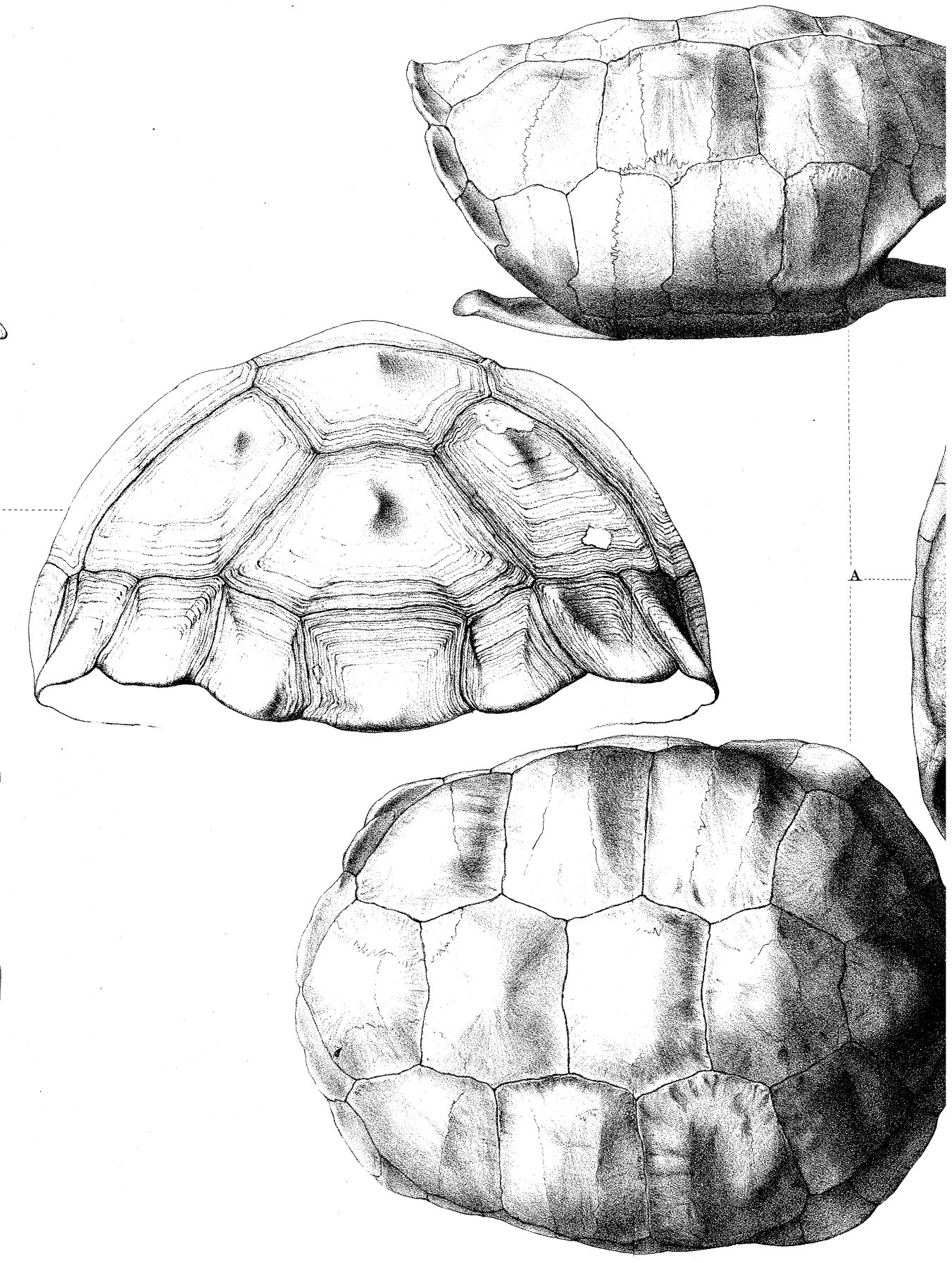
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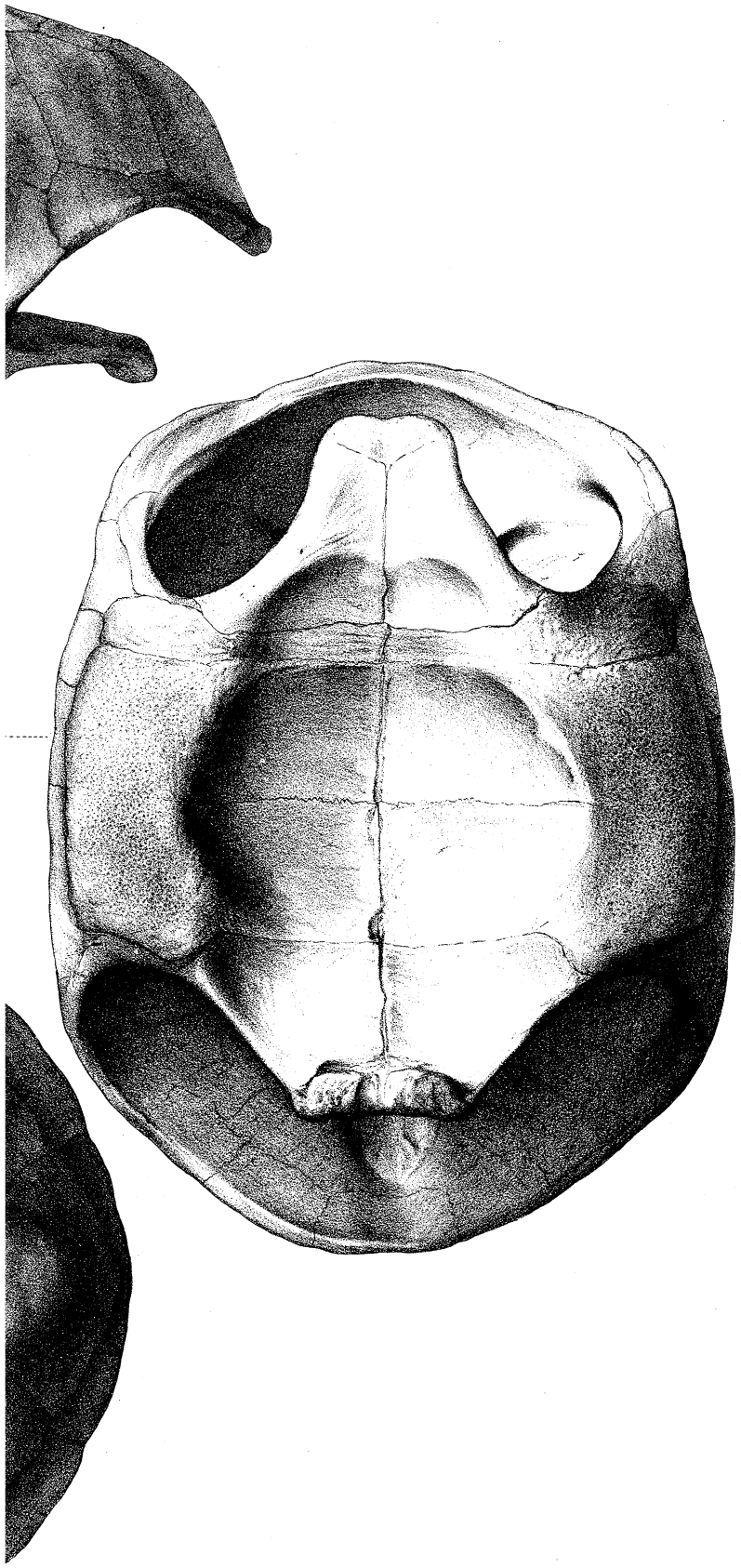

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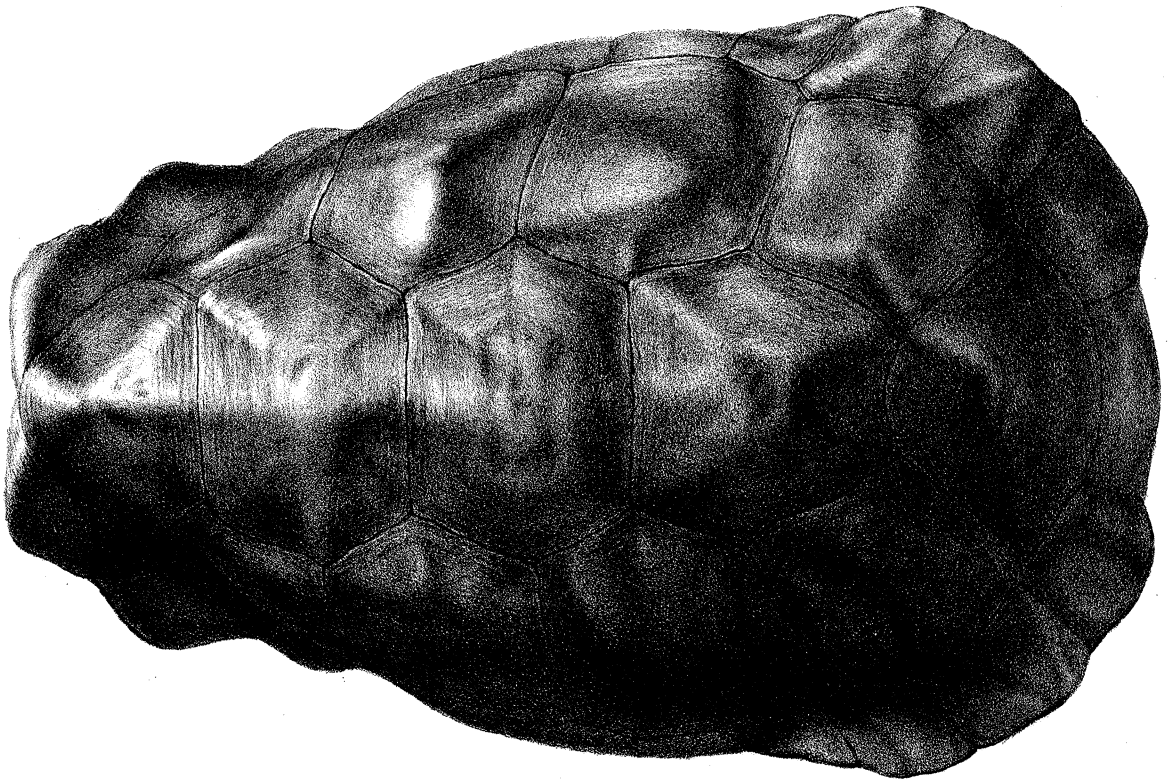

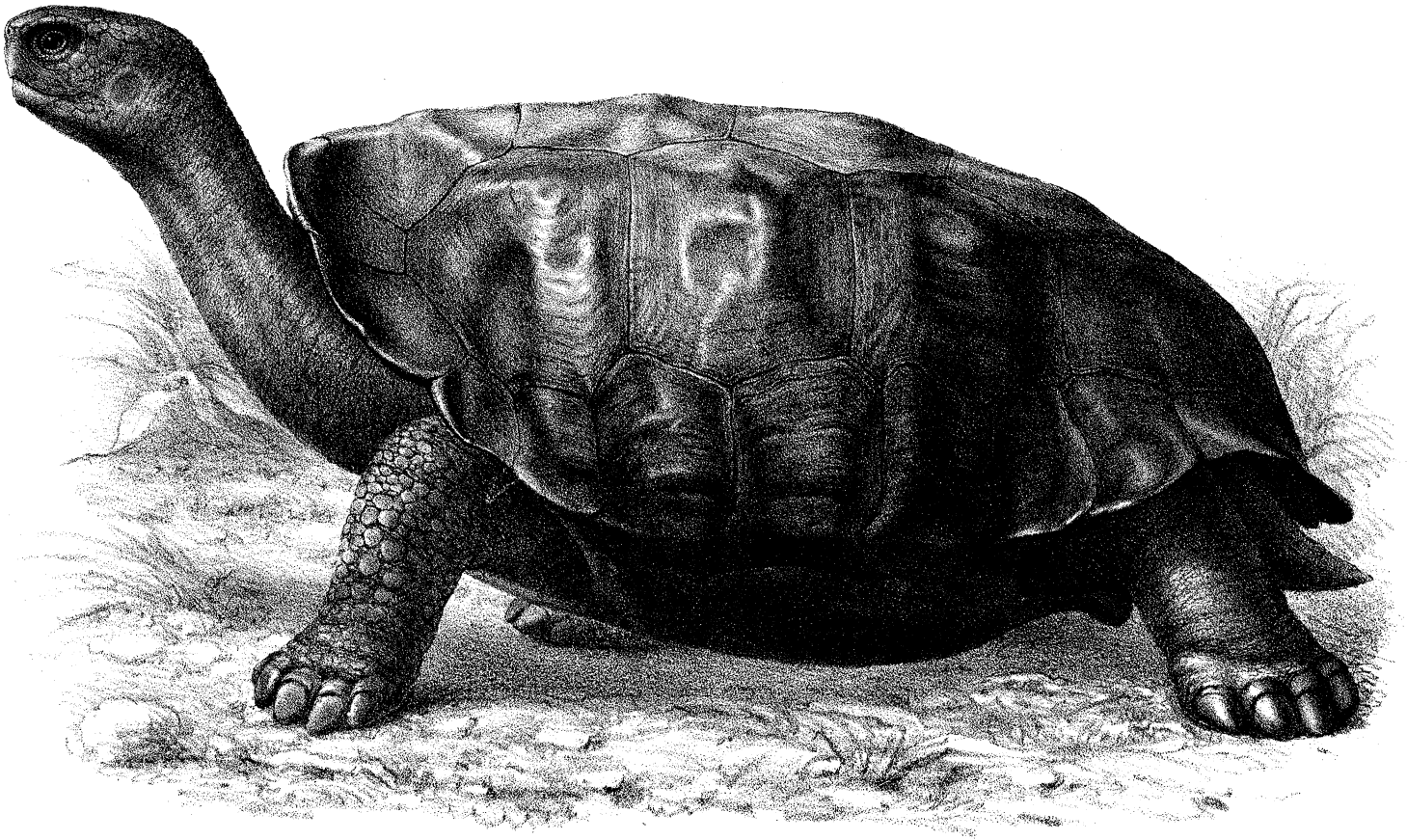

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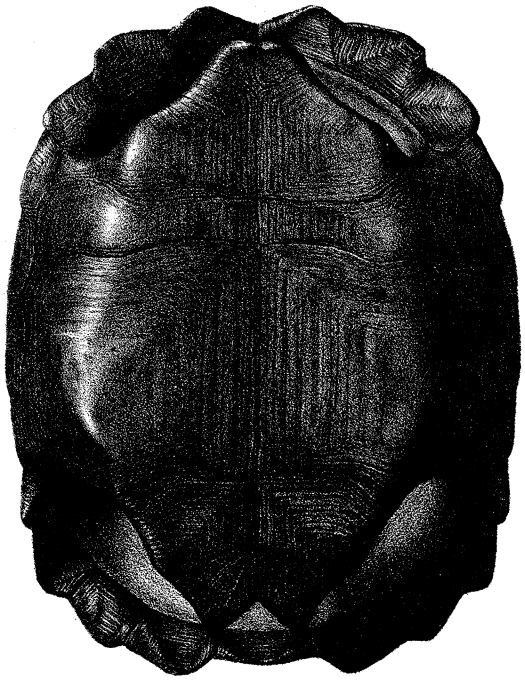

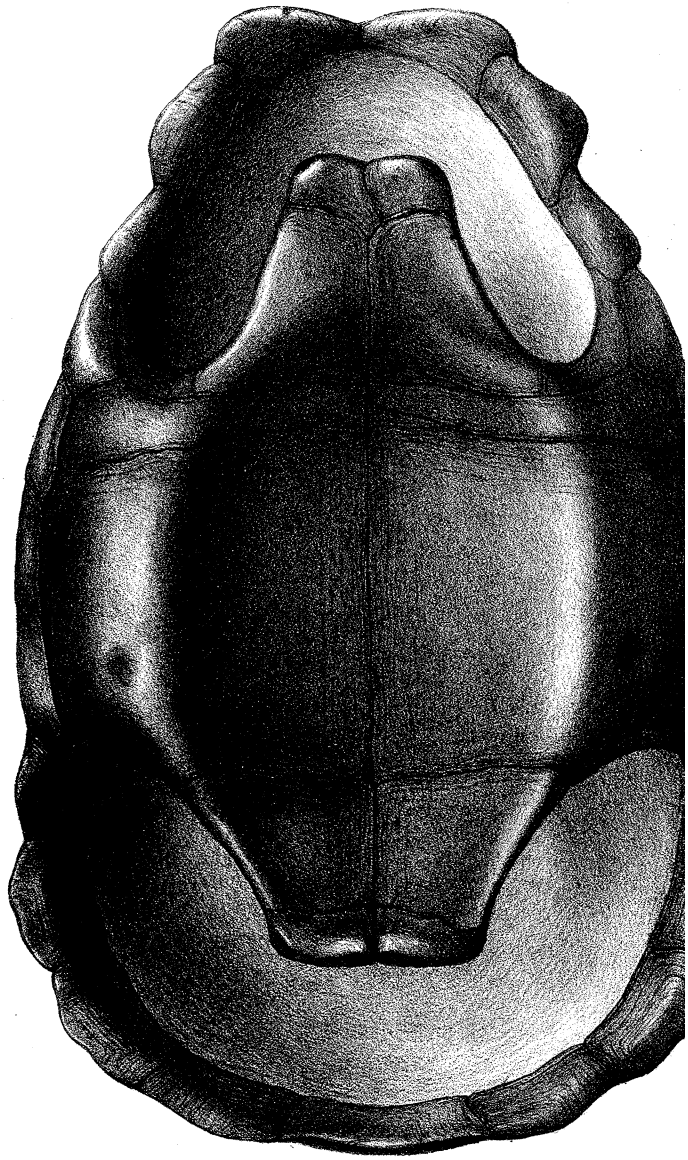

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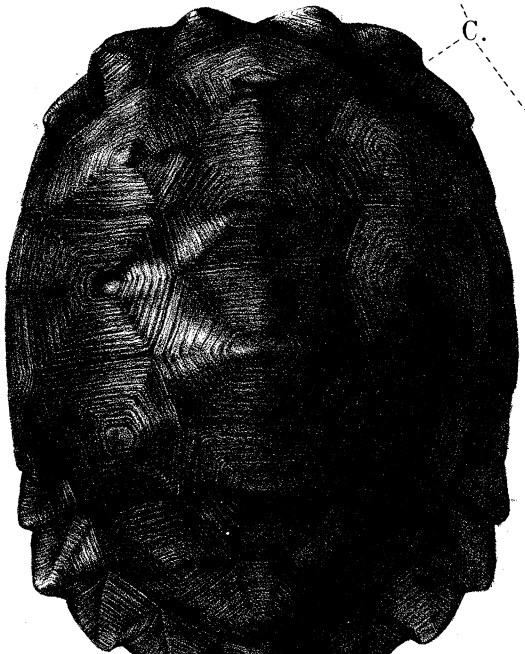

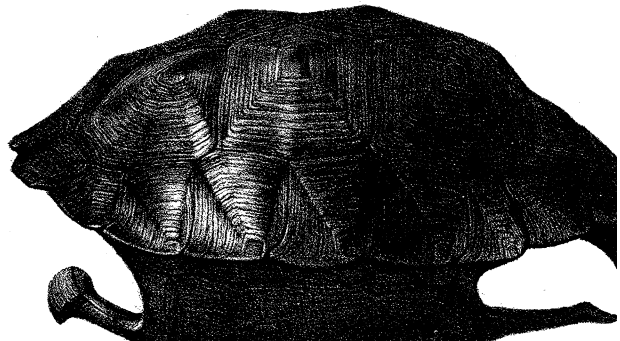

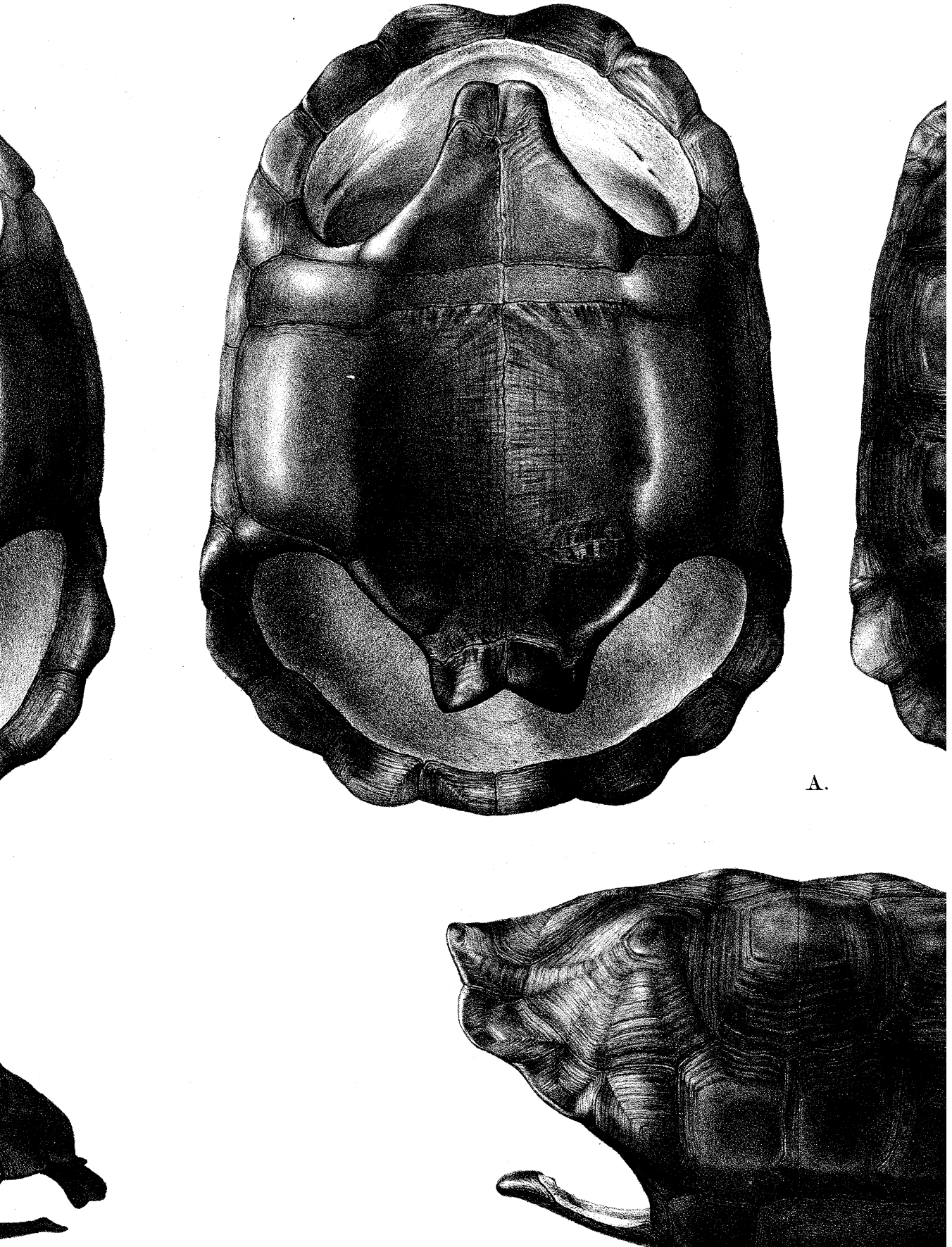

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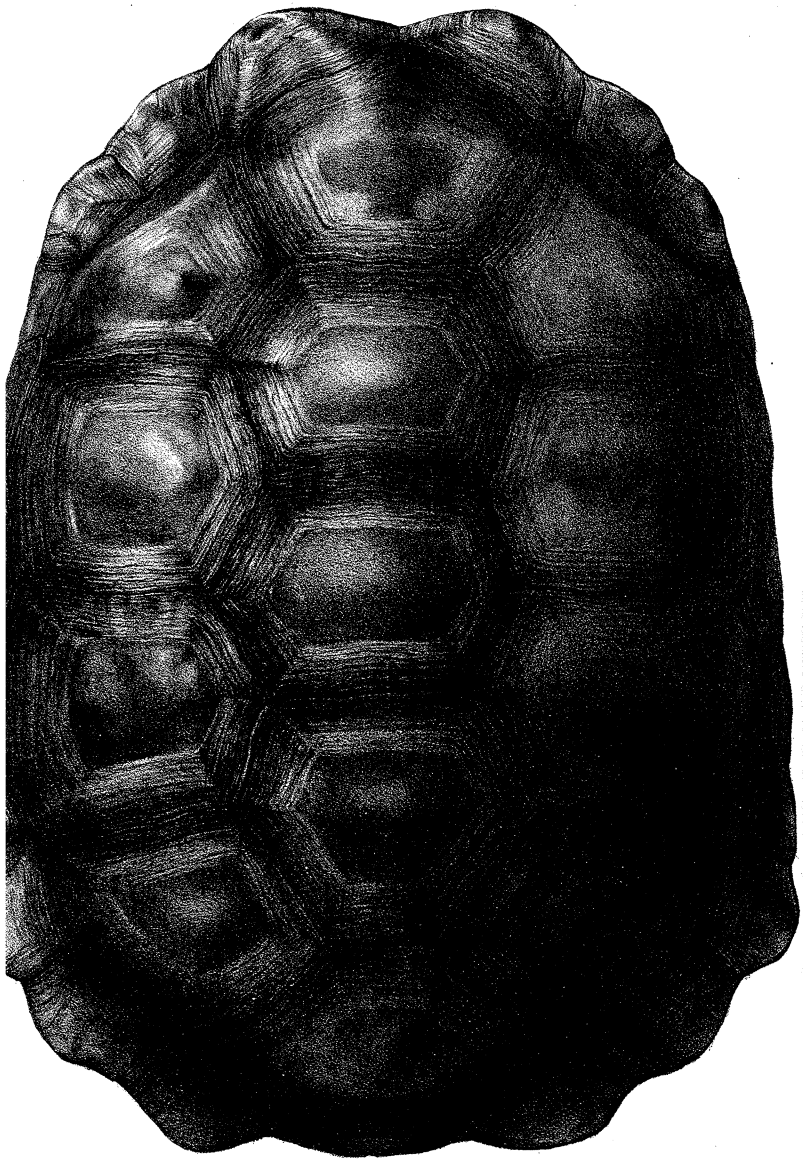

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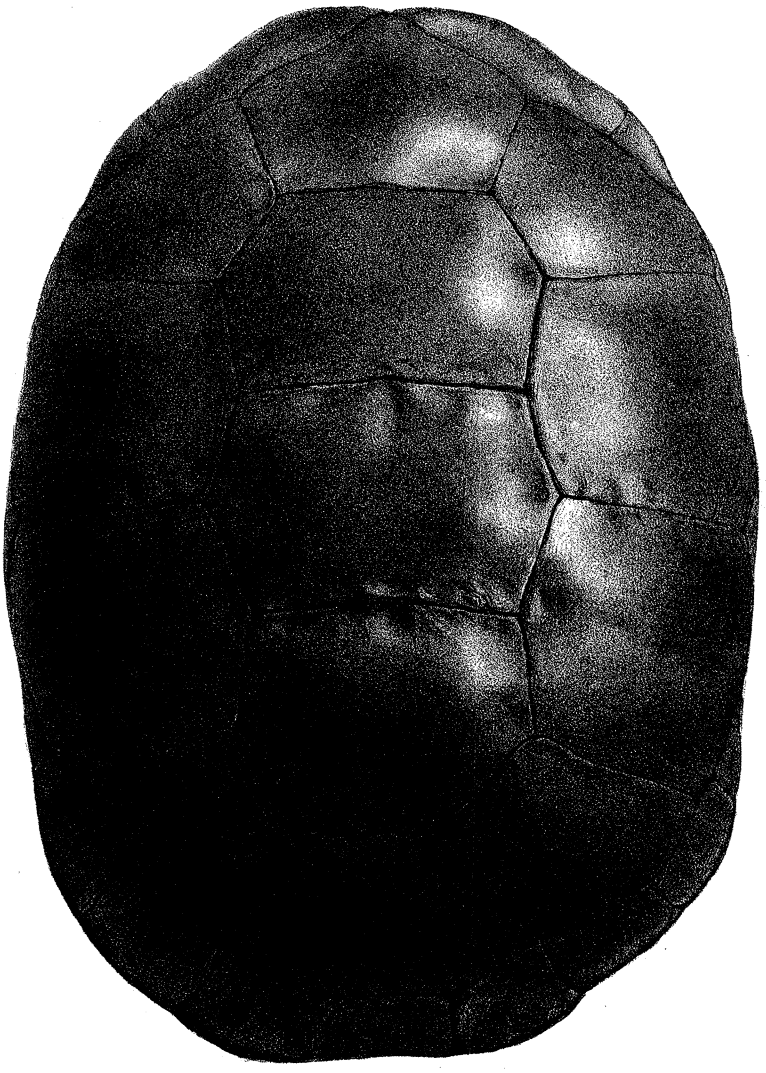

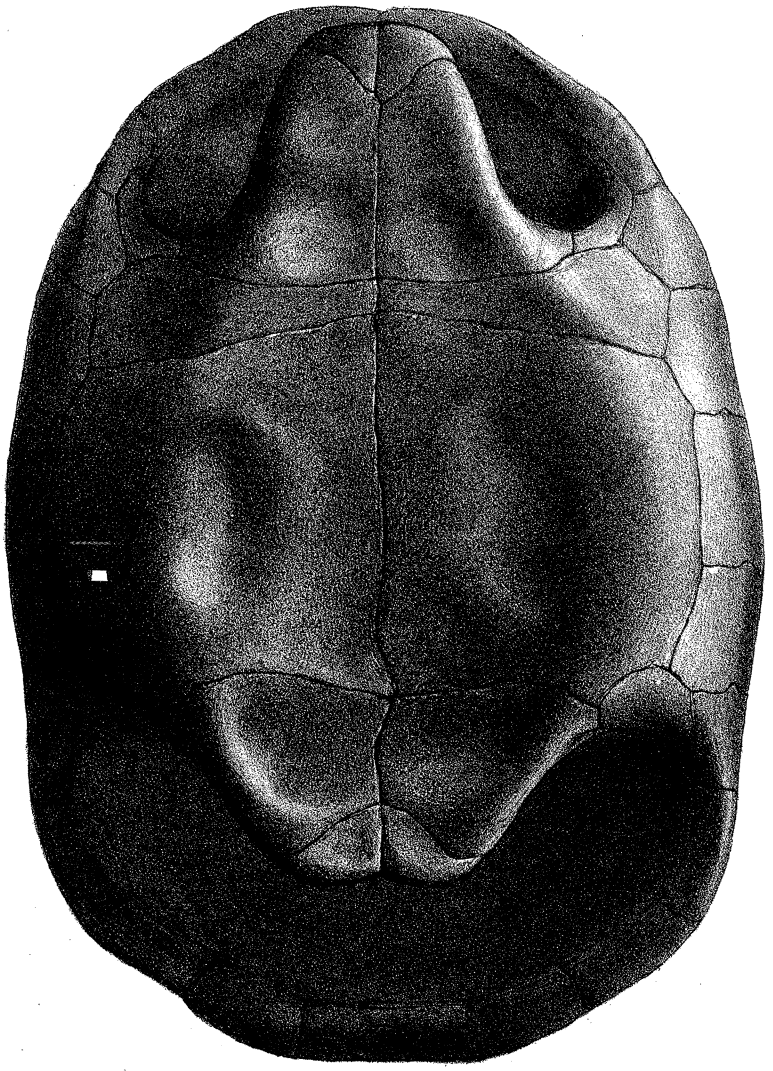

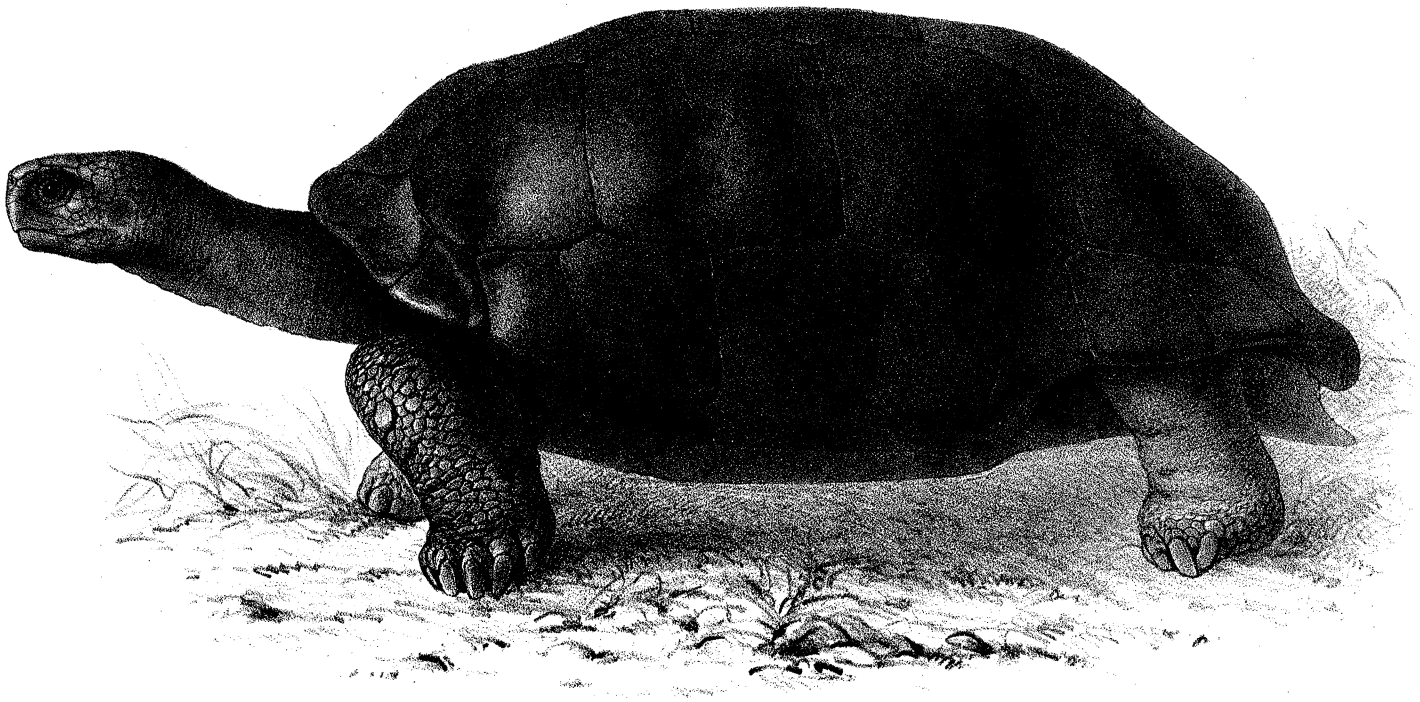

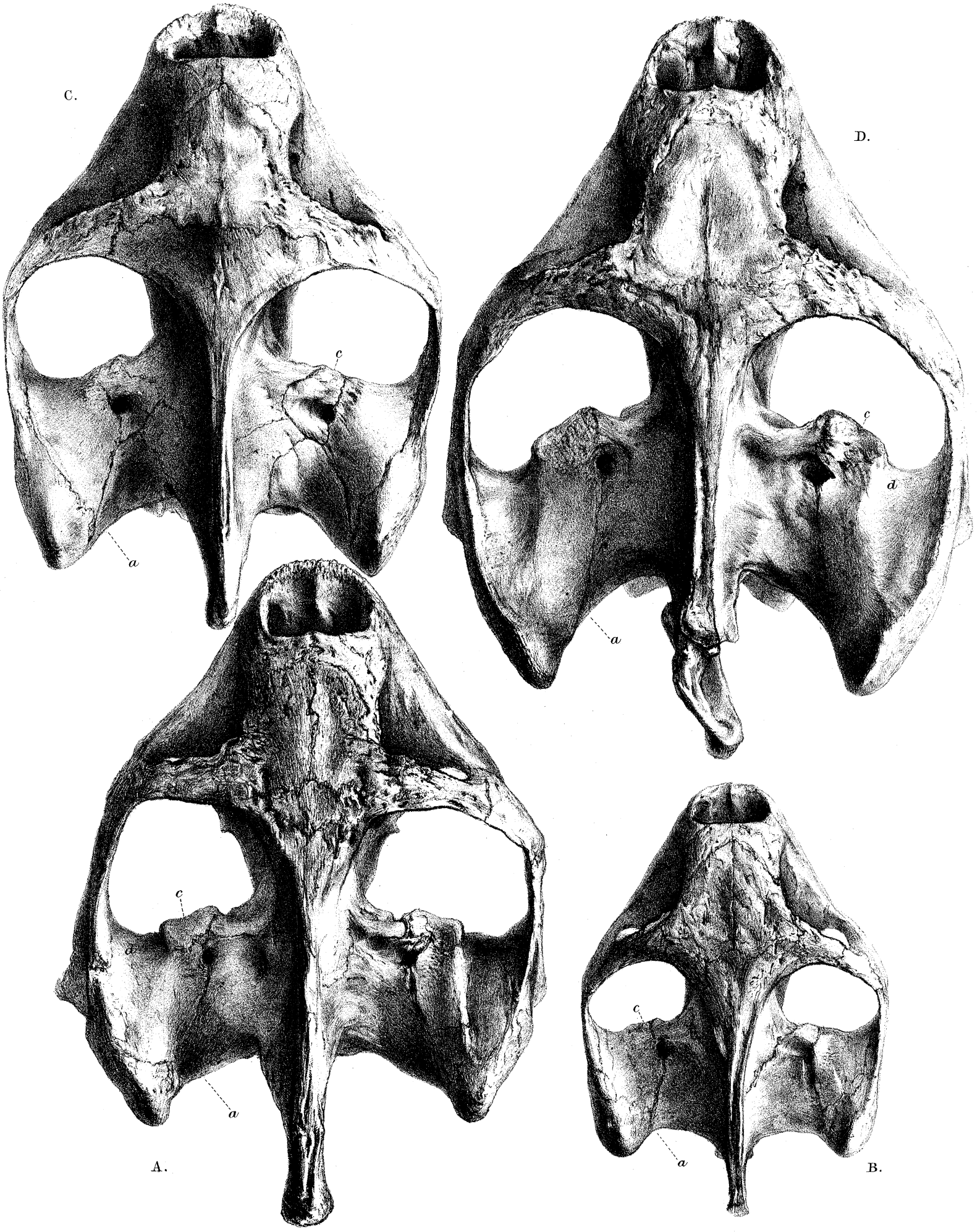
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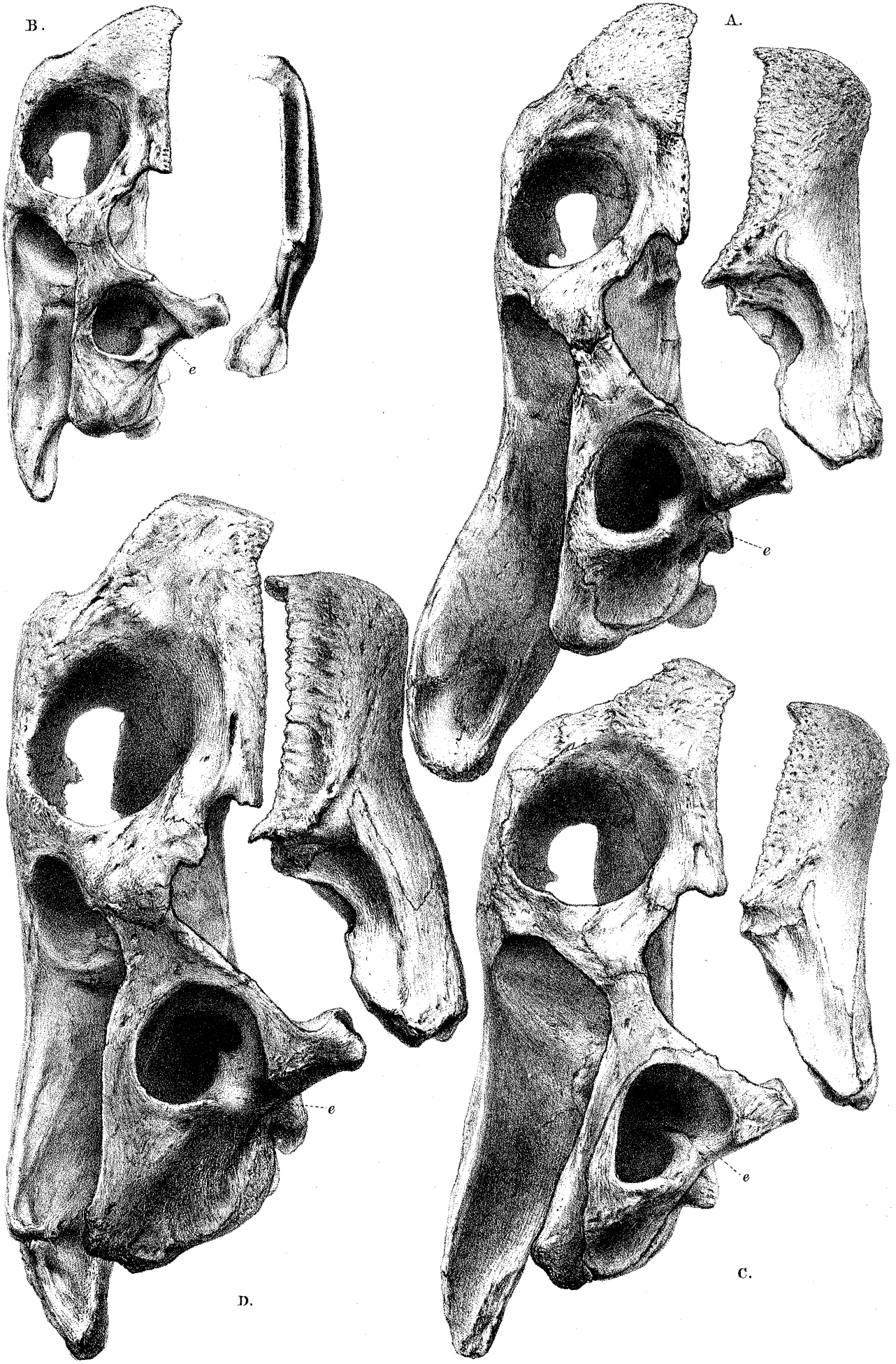
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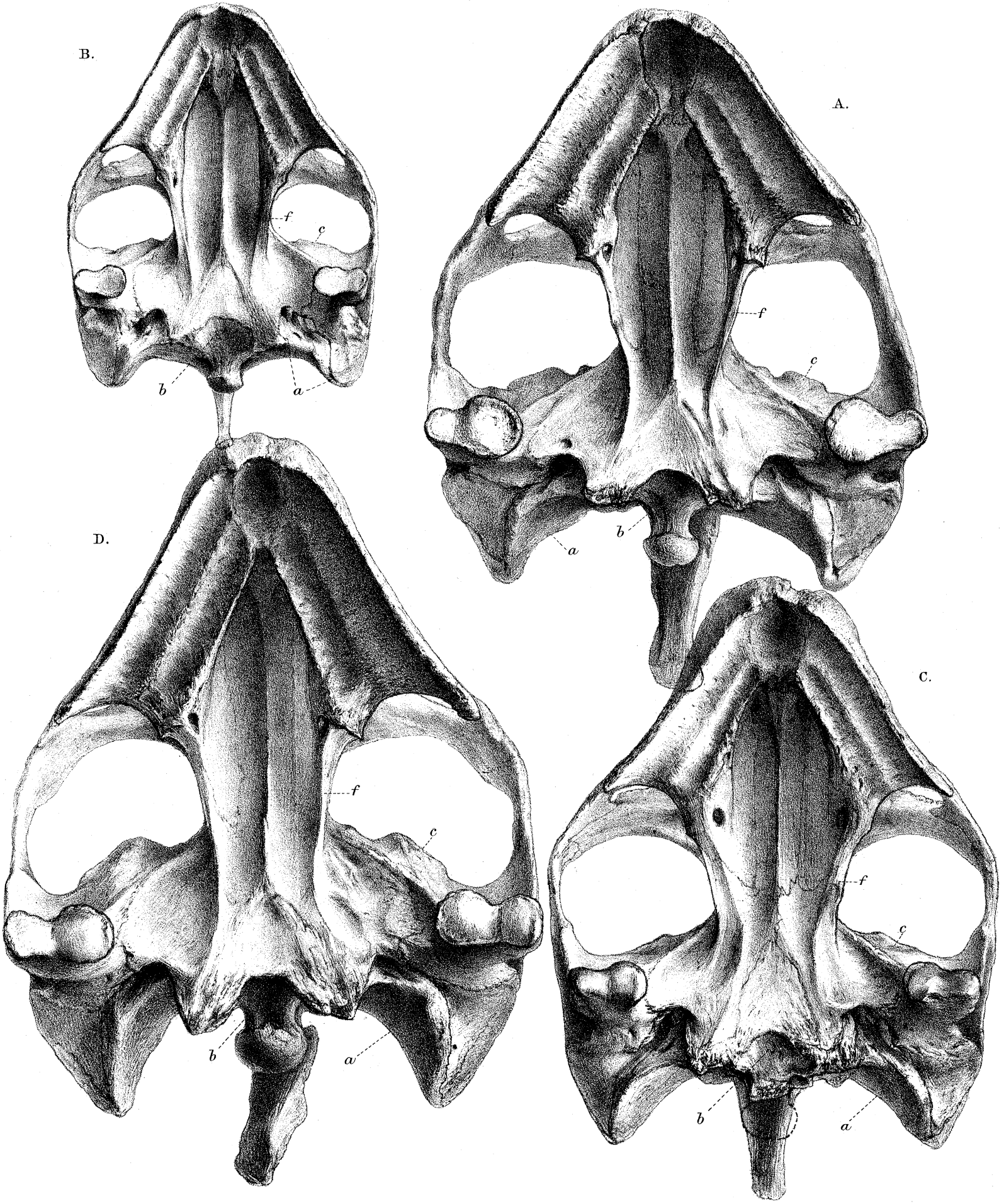
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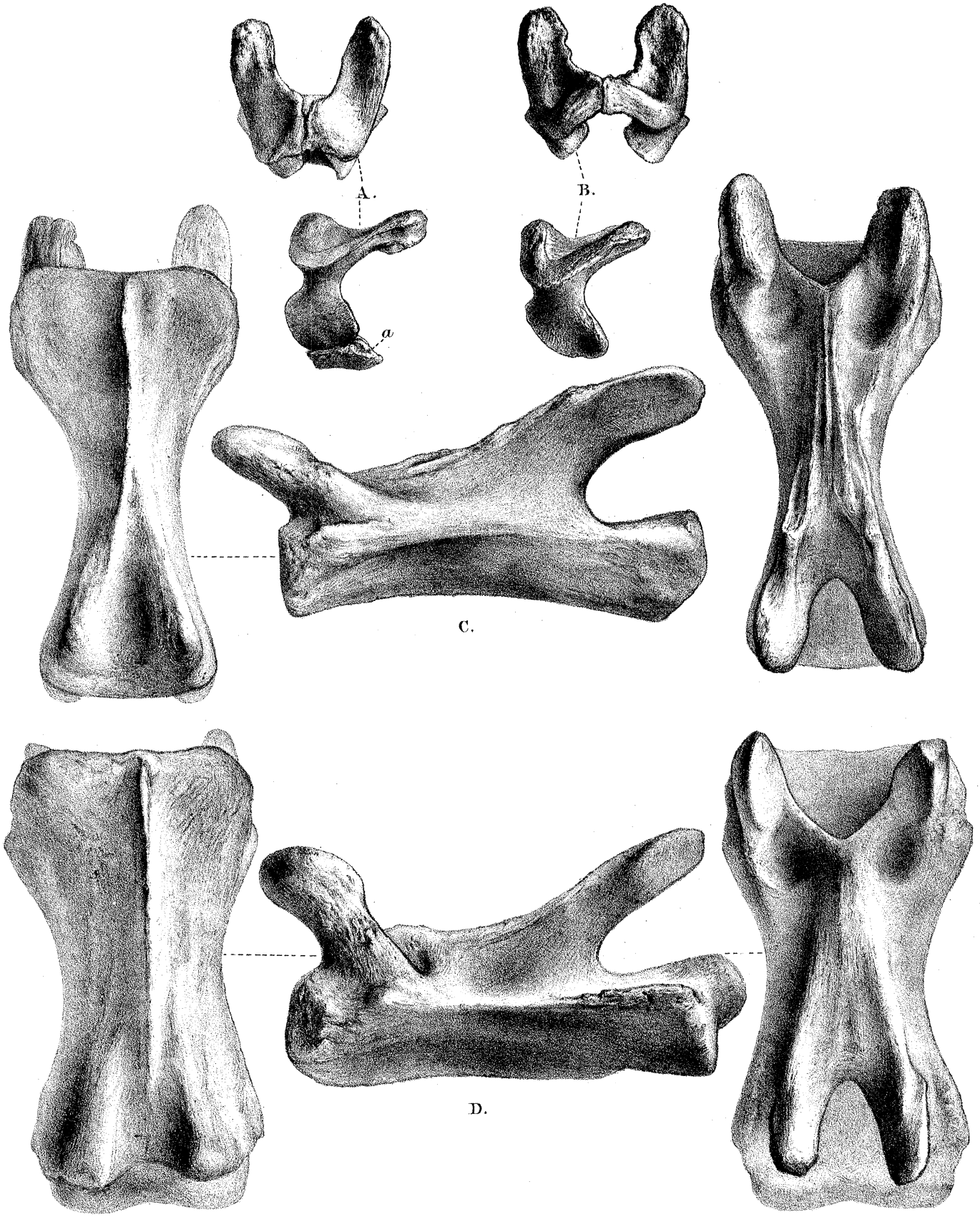
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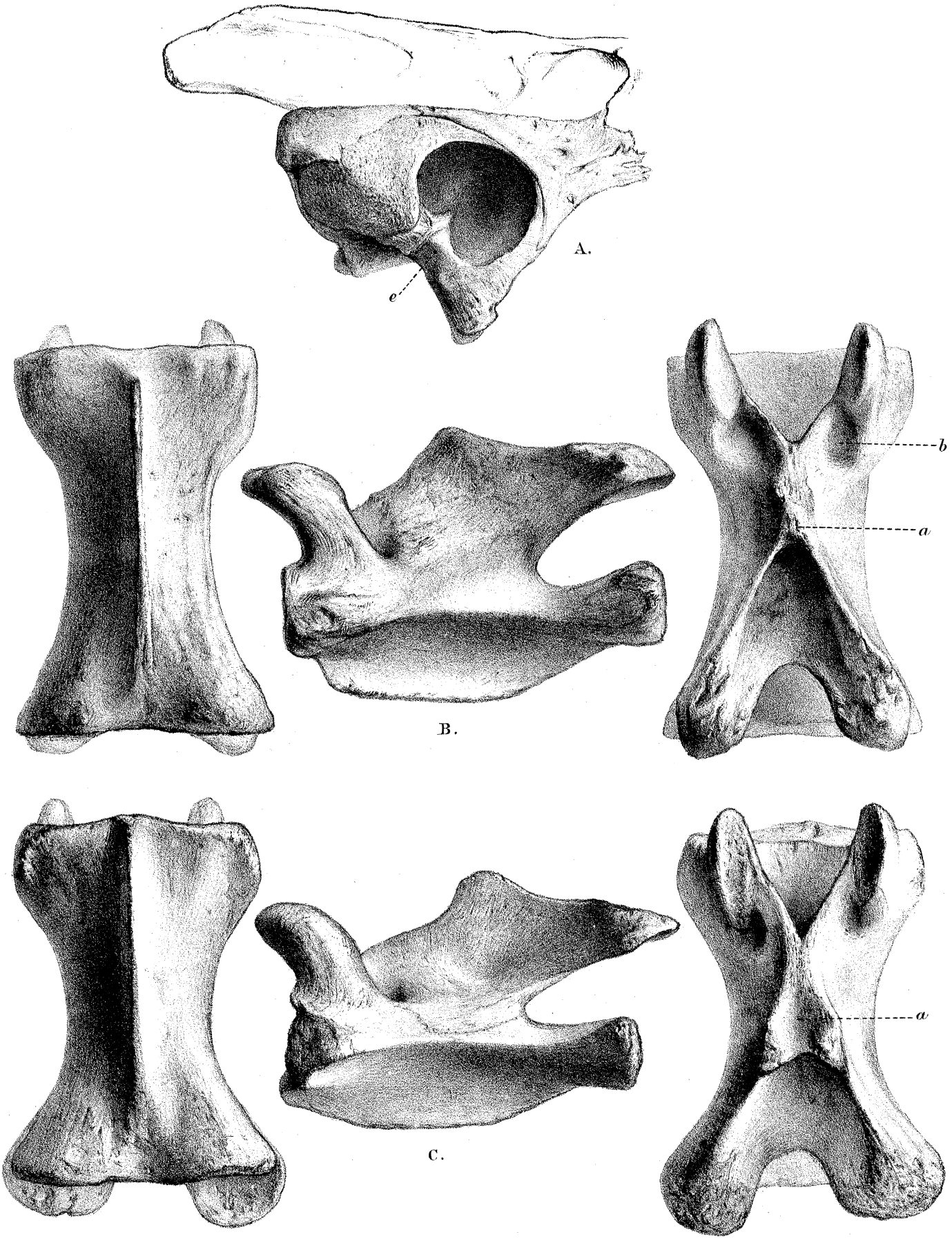
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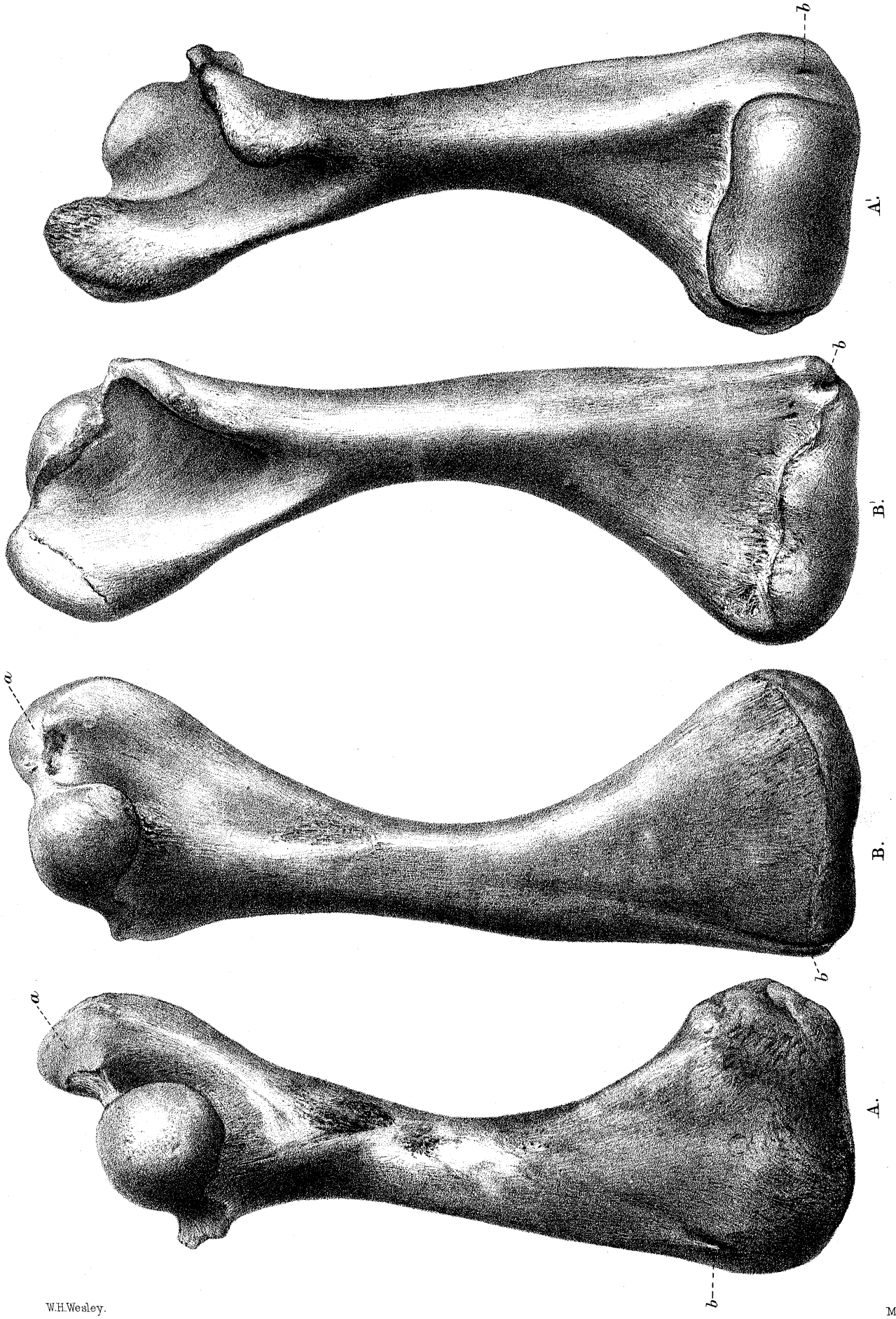

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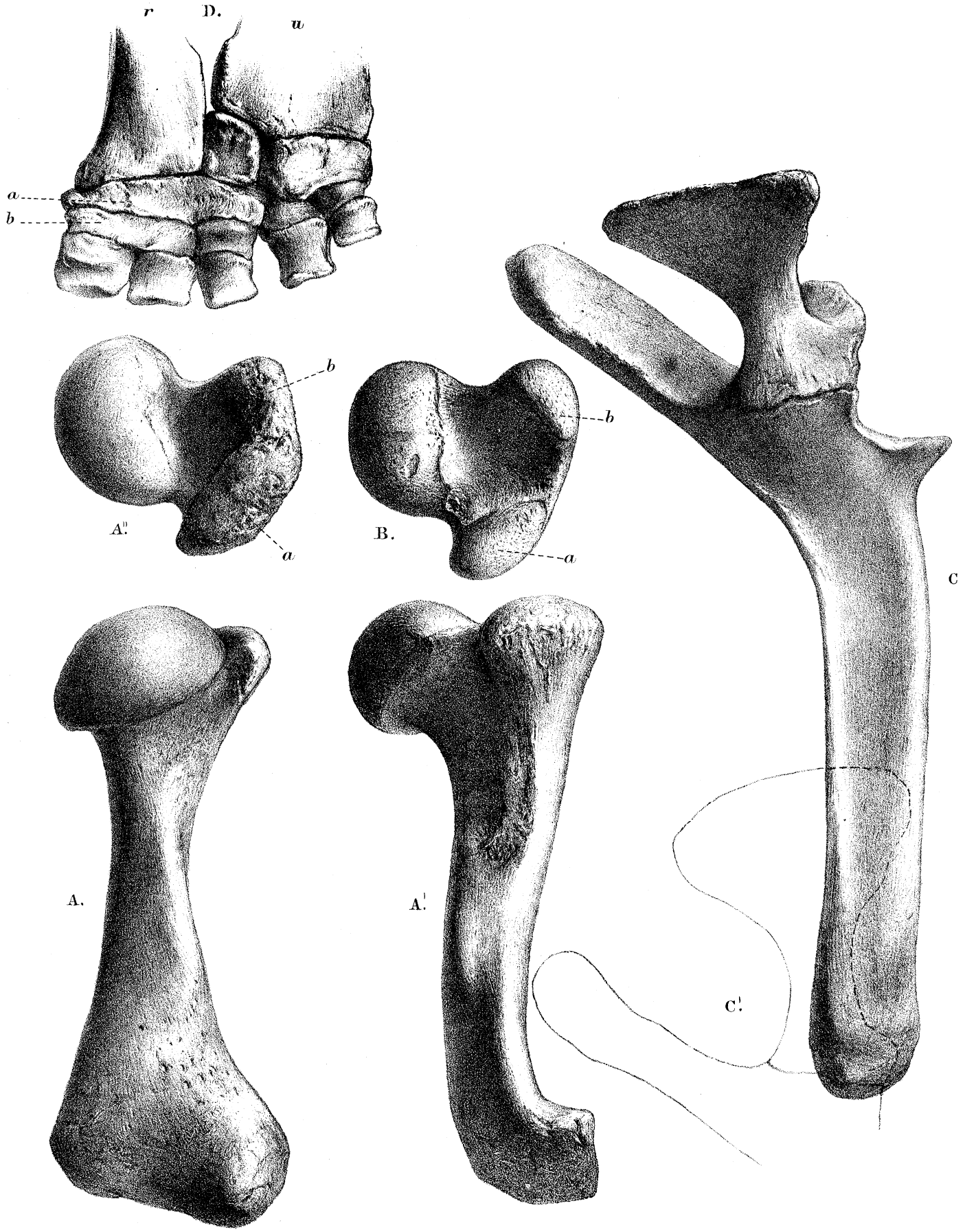
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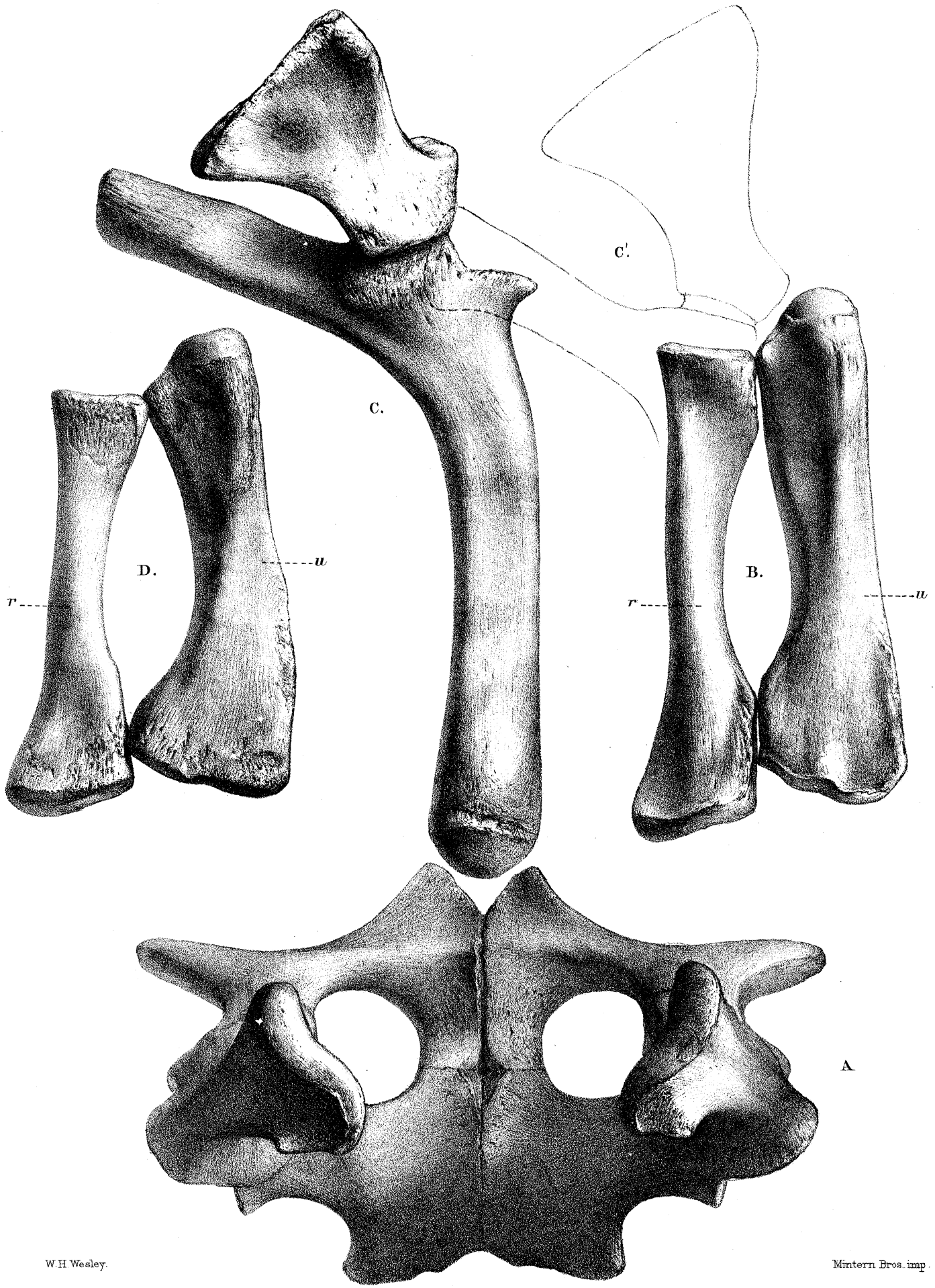

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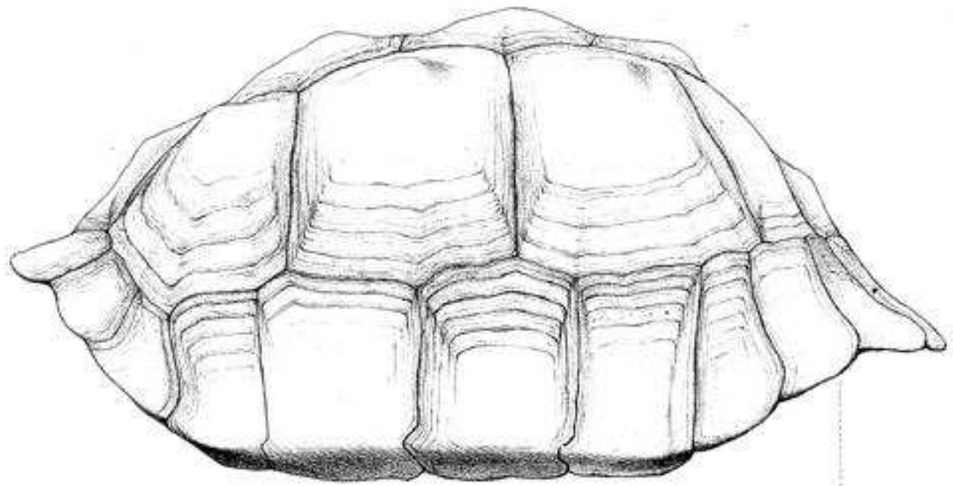

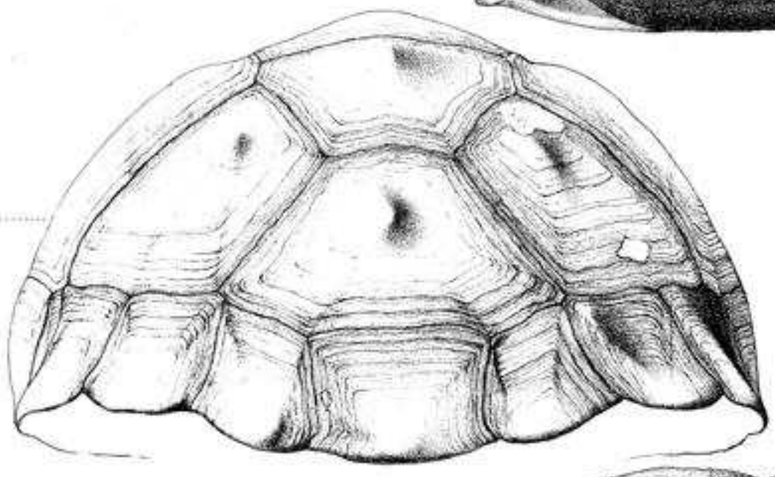

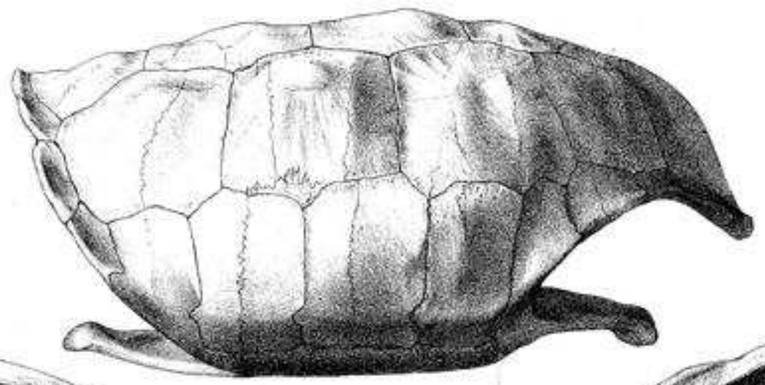

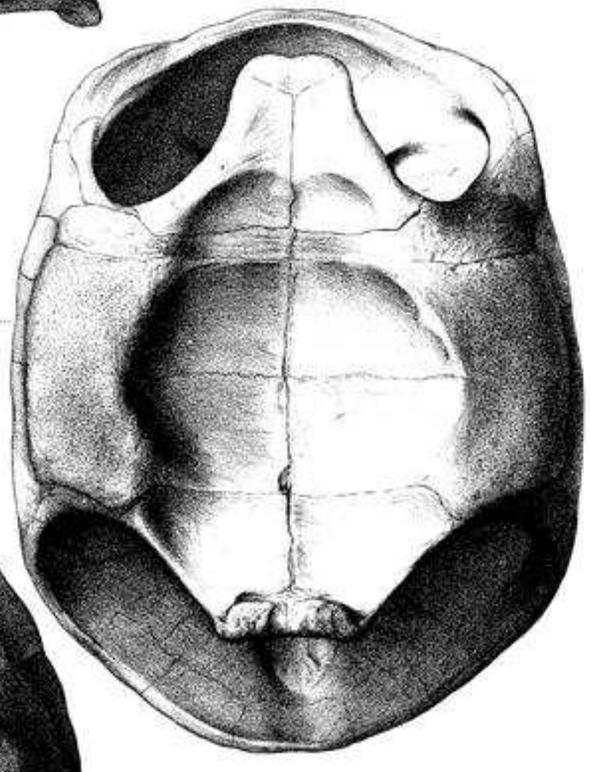

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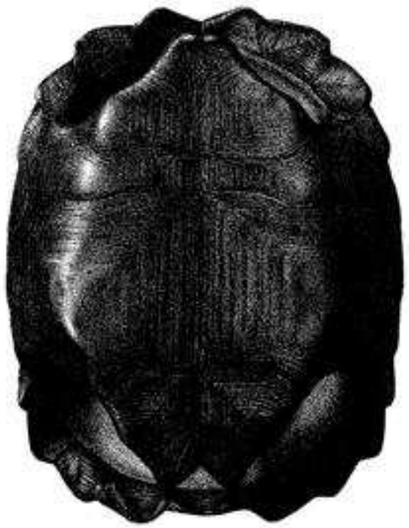

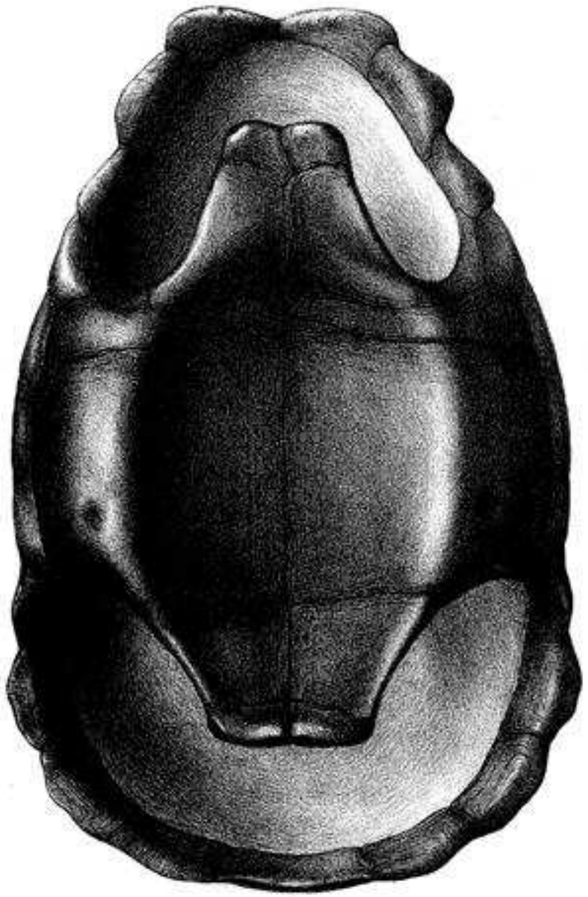

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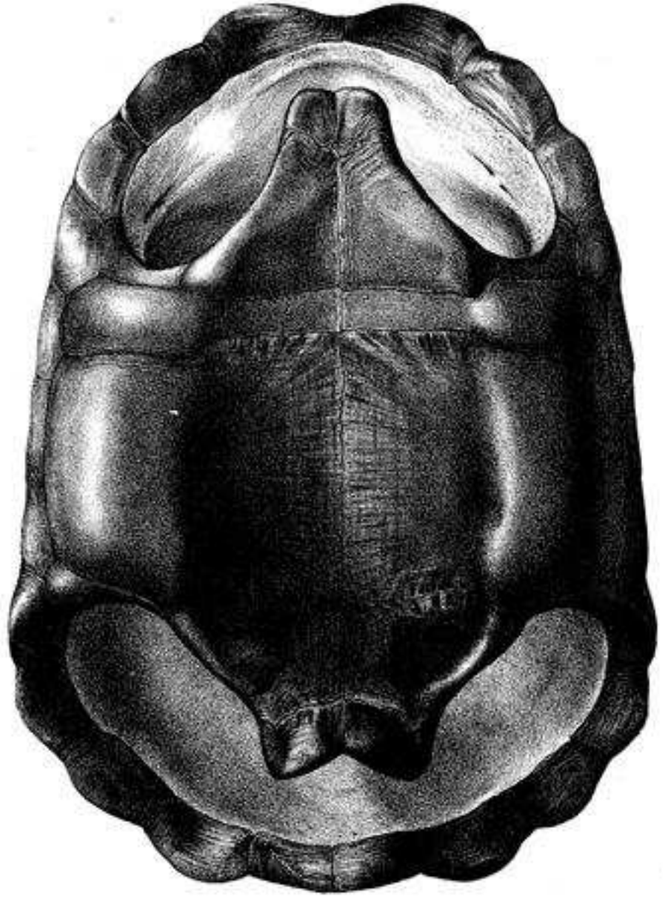

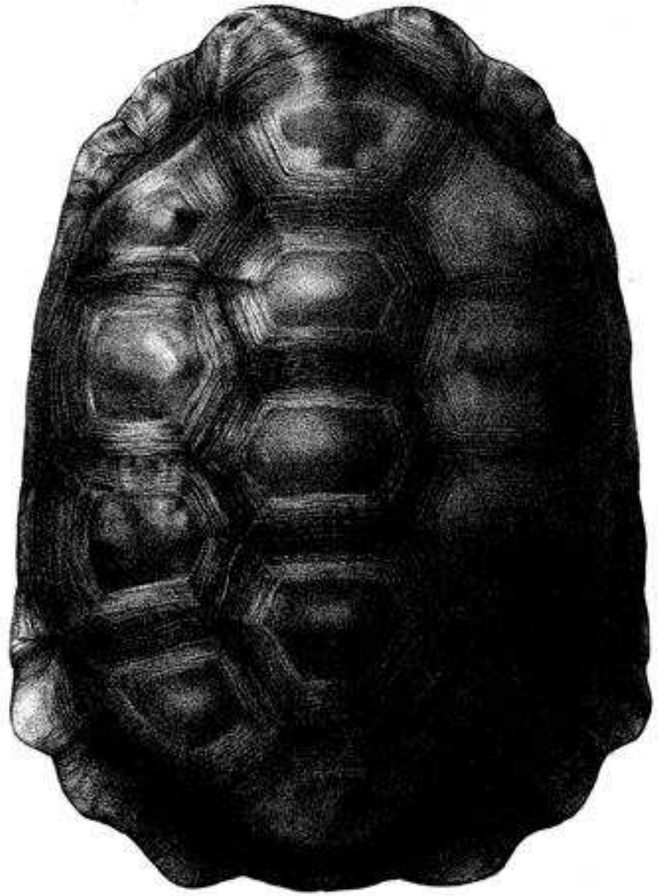

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