

XXVI. *Conjectures relative to the Petrifications found in St. Peter's Mountain, near Maastricht.* By Petrus Camper, M. D. F. R. S.

Read July 6, 1786.

THE discovery of a great number of petrified bones about the year 1770, in the mountain of St. Peter at Maastricht, and particularly of large jaw-bones with their teeth, suggested to the late M. HOFFMAN, first Surgeon to the Military Hospital at Maastricht, a worthy member of several learned Societies, and a great admirer of natural history, the idea that these maxillæ belonged to crocodiles. This notion was spread by himself and his literary correspondents through all Europe.

He did me the favour to send me, not only the history of those petrifications, but also several figures of the jaw-bones in question, and of other bones, which were all intirely new to me, except some fragments of the bones of turtles. I discovered, however, at the very first sight, the characteristical differences which distinguished these bones from those of crocodiles, of which I had at that time several in my collection.

His intention was to write upon this subject, and to send his essay, containing his reasons for supposing these bones to belong to crocodiles, to the Royal Society; but I dissuaded him, as a friend, from doing this, lest he should afterwards be under a necessity of retracting his opinion: and I sent him a figure of

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the lower jaw of a crocodile, accurately done by my own hand, and soon after the skull and under jaw of a pretty large crocodile; which induced him to defer his design of writing about these antiquities of the old world, until he should be better informed on the subject of cetaceous fishes.

Major DROVIN, of Maastricht, who made, about the same time, a collection of an infinite variety of corals, madrepores, alcyoniums, echinites, belemnites, shells, and petrified wood, from the same mountain and its environs, likewise procured a beautiful specimen of two maxillary bones of the same incognitum, but with the infides turned outwards; and this gentleman also supposed them to belong to the crocodile. A sketch of this specimen is to be found in M. BUCHOZ's *Dons de la Nature*, tab. 68. But the specimen itself is now in TEYLER's Museum, at Haerlem, with the whole of Major DROVIN's collection.

Another still more valuable and perfect specimen is to be seen at the house of the reverend Dean GODDING, of which there is likewise a rough sketch in M. BUCHOZ's *Dons de la Nature*, pl. 66. In this the greater part of both the upper and under maxillary bones is intire, and a bone, with small teeth, belonging to the palate; by which it appears, the animal had not only teeth in the jaw-bones, but also in the throat, as several fishes have, but which are never found in the mouth of crocodiles.

Notwithstanding all my endeavours to convince my friends, and afterwards M. DROVIN, and particularly the Dean, whose valuable and truly beautiful specimens I saw in the year 1782, I never could prevail upon them to adopt my opinion, that these bones belonged to physeteres or respiring fishes. M. HOFFMANN, adhering closely to the Linnæan System, objected,

jected, that the physeteres had teeth only in the lower jaw-bone, whereas this fossil monster had them in both upper and lower maxilla. He did not seem to recollect, that *φυσήτης* signifies something respiring, or breathing, and applied to fishes, *breathing fishes*; nor that the physeteres, according to the Linnæan system, have small teeth in the upper jaw-bone, though larger ones in the lower jaw, according to the observations of Dr. OTHO FABRICIUS, in his *Fauna Groenlandica*, p. 42. where he mentions the *macrocephalus*, and p. 45. where he speaks of the *microps*.

In August 1782, I sent M. GODDING, who had favoured me with a copy of his valuable specimen, a full demonstration of its being the head of a physeter, or breathing fish, Delphinus, or Orca, or under whatever genus it may be ranked, as having large teeth of the same size in both the maxillæ. But in vain; for he continues still to call it a crocodile, as if its value depended upon the species of the animal.

The analogy of all the other marine bodies seems to make it still more probable, that these large bones belong to the inhabitants of the sea, and not of rivers. The large turtles, the numberless echinites, madrepores, shells, alcyoniums, belemnites, orthoceratites, and so on, are all sea animals; and the crocodile would, in that case, be the only inhabitant of the rivers mixed with them.

The pretended crocodile found near Whitby, in Yorkshire, Phil. Transf. vol. L. p. II. 1758, § 92. p. 688. and *ibid.* § 108. p. 786. is undoubtedly the skeleton of a Balæna.

§ 2. After the decease of M. HOFFMAN, his family having offered the whole collection for sale, I went in August 1782 to Maestricht on purpose to examine it; and I could not but greatly admire the richness and beauty of the collection, espe-

cially that of the fossil bones from St. Peter's mountain; but as the heirs did not consider the expences necessary to transport the collection down the Maese, where each sovereign puts an enormous duty upon every thing that passes through his territories, nor the small number of persons who were likely to purchase it, they rated the price so high that nobody chose to bid for it.

The eldest daughter having at length become possessed of the whole, offered me the principal specimens at a price I agreed to. Amongst them were the duplicates I have already sent to the British Museum, and with which the honourable Trustees are perfectly satisfied. These specimens may serve likewise to ascertain what I have said about them, as being real fragments of physeteres, some of turtles, and the like, but not a single one of any species of crocodile.

§ 3. The arguments for their being jaw-bones and vertebræ of fishes seem to be, first, the smoothness of these bones; and, secondly, the many holes by which the nerves go out at the side, and under each tooth, as is very evident in that beautiful specimen now in the British Museum, on the outside of which eleven holes are visible, in the same manner as they are in the delphini, and more particularly in the lower jaw-bone of the cete, the *Physeter macrocephalus*, or pot-fish, cachalot, &c. Thirdly, the form of the teeth, which have solid roots, as in tab. XV. fig. 6. B, C, E, F, and the six teeth of tab. XVI. Fourthly, because there are little teeth in the palate, as in Dean GODDING's specimen. Fifthly, because the vertebræ have the appearance of true cetaceous vertebræ, as in fig. 5. tab. XV. and in several beautiful and large specimens now in the Museum. Several of these vertebræ were besides intirely unknown

known to me, and not at all analogous to the vertebræ of the crocodile, described and represented by Dr. N. GREW.

§ 4. As I intended to visit London in 1785, I flattered myself I should still find the skeleton of the great crocodile formerly at Gresham College, and be able to find out such characteristic distinctions as should be necessary to decide the question. Dr. GRAY was so kind as to go with me to the lower apartments of the British Museum, where we found, though not without difficulty, the skeleton much neglected, spoiled, and deprived of several interesting parts. I admired, nevertheless, the remainder of it, being infinitely pleased with the transverse futures, tab. XV. fig. 1., 2. *a, b, c, f, δ, ζ.* by which not only those of the neck and thorax, but those of the loins also, are divided, and which I made a drawing of, as large as the life, the 20th of October, 1785, of which fig. 1. and 2. are very accurate copies.

I confess I had not observed that particular division or future in the skeleton of a small crocodile, of thirteen inches, made by my youngest son; but after being apprized of it by the large skeleton in the Museum, of twelve feet four inches, Paris measure, on looking at my own when I returned home, I found them both alike, and that those parts were not epiphyses; of which, however, the transverse processes of the neck. fig. 1. *d, e, q, o, n, p,* have all the appearance, though there is no other epiphysis to be observed in the rest of the bones of that large skeleton.

When we compare the fossil vertebra, fig. 5. with those now in the Museum, we shall find the epiphyses AB, CD, analogous to *a, b, c, d,* fig. 4. being the real epiphyses in the vertebra of a young porpoise.

I procured,

I procured, in London, the largest vertebræ of the neck of a turtle I could get, and prepared two of them as in fig. 3. in which, as along the back of that singular creature, I found the transverse divisions *a, c, d, f*: of all which I have not seen a single instance amongst the dorsal spinæ from St. Peter's mountain, one of which consists of seven, another of twelve, and a third of fourteen vertebræ. Some of the vertebræ have, I acknowledge, an inferior process, as in the crocodile, *l, m*, fig. 1. Of these I have sent likewise two to the Museum. The ostrich, and the turtle *Mydas*, have such processes, but no quadruped I know of.

The articulation of the vertebræ with each other, by the surfaces of the bodies themselves, is intirely different, not only from that of the crocodile, but from that of all the cetaceous fishes I have ever seen: and I dare venture to assert, I have seen a great many, exclusive of those in my collection. The anterior part of the Maestricht vertebræ is more or less triangular and hollow, as in fig. 5. C, D, L. The posterior A B is convex. Both these surfaces are very smooth, as if they had been covered with a very thin cartilage, and moved one upon the other, without being united by an elastic lamella, as in all quadrupeds and cetaceous fishes; in which the vertebræ have on both the surfaces a round brim, or circular edge, *a, b, i, b*, by means of which the ligaments are connected, and a flat hollow surface within, as *b, i*, fig. 4. for the elastic pulp that is between them.

§ 5. The dentition is so singular in these fossil jaw-bones that it deserves a particular description. In all quadrupeds, as in man, the teeth which appear first are all shed at a certain period of life, and in the mean time new ones are formed above, under, or at the sides of the primordial or temporary teeth,

teeth, but in different sockets. The grinders are not all renewed, but in general three when there are six, and two when there are five. Nature, however, is not always uniform in this operation. Mr. JOHN HUNTER, a worthy Member of our Society, has given a very interesting and complete natural history of the teeth, in which these observations are stated.

In the crocodile the succeeding or secondary teeth appear even when the animal's head is equal to two feet; that is, when it has acquired one-third of its usual growth. When they grow too fast, before the temporary tooth is shed, they perforate the side of the bone, at the part where they meet with the least resistance. Instances of this variety occur in the large crocodile's head, which is in my collection.

In all quadrupeds the enamel is, of the solid parts of the teeth, the first formed, making a cavity, in which the other bony substance is deposited, and formed by lamellæ placed one within another, as is observed by Mr. JOHN HUNTER in the work already mentioned, p. 92. To this the root is added, which is filled in the same manner till the tooth is long enough to pierce through the gums.

But in the fossil jaw-bones of St. Peter's mountain, a small secondary tooth is formed, with its enamel and solid root at once, within the bony substance of the primordial or temporary tooth itself, as is to be seen in the small fragment now in the British Museum, and in tab. XVI. A, B, C, D, E; which, by continuing to grow, seem to make by degrees sufficient cavities in the bony roots of the primary teeth: but what becomes of them at last, and how they are shed, I am not able to guess. I have one in my collection, where the succeeding tooth is intirely formed within the center and substance of the primordial tooth. In the 6th figure (tab. XV.) a little oval cavity is observable,

observable, which has been the seat of a new or secondary tooth.

§ 6. The maxilla inferior of the incognitum, sent by me to the British Museum, is a most magnificent specimen, having fourteen teeth. A similar one, somewhat longer (as it measures  $3\frac{2}{3}$  feet) in my own collection, has also fourteen. Another fragment of the left side, two feet long and eight inches broad, shews the primordial and succeeding teeth in the clearest manner.

The specimen, of which I sent a drawing (tab. XVI.) to the illustrious President of our Society, Sir JOSEPH BANKS, is still more useful to confirm the mode of dentition than any other I have in my museum.

§ 7. Several ribs and the phalanges of the toes of the fore-feet, a specimen of which I sent in a fragment from the same rock, of about a foot long and eight inches broad, may serve as another proof of the difference between these and the crocodile's toes, when compared with the still valuable, though neglected, skeleton in the British Museum; which I am sorry I could not make a drawing of, having been too much employed on other objects.

All these characteristic differences cannot fail to convince the learned Society of the truth of what I have asserted, about the animal these bones belonged to; for though we cannot determine exactly the species itself, yet I flatter myself the preceding observations evidently prove, that they did not belong to any animal of the crocodile kind.

§ 8. Another very beautiful specimen, a foot and a half long, and about ten inches broad, I have been induced to add, because it contains the anterior part of the scutum of a very large turtle. Of this Mr. JOHN HUNTER has an analogous bone



bone from the same mountain in his valuable collection, but sent to him under another name. I am convinced it belonged formerly to a turtle; first, because I have from the same mountain the intire back of a turtle, four feet long and sixteen inches broad, a little damaged at the sides, and a pretty large fragment of another turtle, in my possession. 2dly, Because I have a similar one, but so placed within the matrix as to shew the inside, which is perfectly analogous to the inside of that piece in the back of a large turtle I got in London, by the favour of Mr. SHELDON. 3dly, Because I have amongst these bones the lower jaw-bone of a very large turtle, of which the crura, though not intire, are seven inches long, and distant from one another six inches; the thickness is equal to  $1\frac{1}{4}$  inch.

All these fragments prove the frequency of turtle bones amongst the other fossil bones found in the mountain near Maastricht.

Dr. MICHAELIS wrote to me some time ago, that the above-mentioned fragment, in Mr. J. HUNTER's Collection, belonged to a bird; which I could hardly believe, as I never had seen in any collection whatsoever, either in London, Paris, Brussels, Gottingen, Cassel, Brunswick, Hanover, or Berlin, nor in my own country, any fossil bone belonging to a bird. I know there is a small one described in the Abbé ROZIER's *Journal de Physique*, for March 1782, which is at present in the collection of M. D'ARCEY, at Paris. I expect also from Montmartre a small leg of a petrified bird; but these are the only ones I have ever heard of, those of Stonefield, near Woodstock, being most undoubtedly of fishes. I think it is a circumstance worthy the attention of the curious, that no human

bones, and of birds but very few, have been hitherto found in a petrified state, and belonging to the old world.

## PETRUS CAMPER.

Klein Lankum, near Franeker,

June 18, 1786.

### EXPLANATION OF THE PLATES.

#### T A B. XV.

Fig. 1, 2. Are vertebræ taken from the skeleton of the crocodile described by Dr. NEH. GREW, in his Catalogue of the Natural Rarities at Gresham College, p. 42. and p. 43.

*a, b, c, f, δ, ζ.* the bodies of the vertebræ; *a, b* of the fourth; *c, f* of the first vertebra of the neck; *β, z, t.* and *x, y, w.* the spinous processes; *γ β.* and *s.* the ascending; *t,* and *u v.* the descending processes; *g, h, c, i. d, e, n, p, o, q.* the transverse, united by cartilages to the bodies of the vertebræ. GREW calls them *offa mucronata*. The transverse processes of the fourth vertebra being lost, the roots of the mucronated processes are very evident at *g h, i k.*

On the under part of these vertebræ are (*l* and *m*) processes, similar to those we find in the vertebræ of the neck in turtles and birds. Not only the six posterior but the five anterior vertebræ of the back are provided with such processes; of these, however, Dr. GREW makes no mention.

Fig. 2. Represents the seventh vertebra of the back; A, and C. are the ascending and descending processes, forming the articulations with the adjacent vertebræ; B. the transverse process, to which is united the rib FB. in B.; DE. the spinous process; H, H, I. the body of the same vertebra.

These figures are as large as the life, and made from the same skeleton, now in the British Museum. The whole length is equal to  $12\frac{1}{2}$  feet, Paris measure; the head equal to 2 feet; the neck equal to 1 foot; the trunk equal to 3 feet 8 inches; the tail equal to 5 feet 8 inches. The measurement given by Dr. GREW does not agree with mine; but he seems not to have taken it with great attention (p. 42.), for he makes use of the words *about, almost, &c.*

OBSERVATION. What struck me was, the transverse suture, *a, b. c, f. d, ζ.* which divided the bodies of all the vertebræ of the neck, back, and loins. This division ended with the os sacrum, which was intire, as were also the vertebræ of the tail. Dr. GREW seems only to have taken notice of the futures belonging to the transverse processes.

I have a small skeleton of a crocodile equal to 13 inches, in which the 7 vertebræ of the neck, 12 of the back, and the 5 of the loins, are divided in the same manner as in the large skeleton in the British Museum. Those of the os sacrum and tail are without, and have no mark of an epiphysis.

CONCLUSION. The transverse division of the vertebræ above-mentioned is also peculiar to this animal; and there is no epiphysis, as in other animals.

To be sure of this, I dissected and made a skeleton of the *Lacerta Iguana*, LINN. sp. 26. perfectly well described by

MARCGRAF, *Hist. Bras.* p. 236. cap. 11.; but I found no such divisions, though the animal was young, and though it had still epiphyfes on the legs, &c. The neck consists of 4 vertebræ, the back of 11, the loins of 9, the os sacrum of 2, as in the crocodile; the tail of more than 60.

The dissection of tortoises seemed to me of consequence, at least a more accurate inspection of the vertebræ, particularly those of the neck, as being analogous in some respects to those of the crocodile, especially in the structure of the inferior processes D, and E, with *l, m*, fig. 1.

Fig. 3. Represents two vertebræ of the neck of a pretty large turtle, natural size.

AB, BC. the bodies; L. and I. the ascending, H. and T. the descending processes; R. K. the spinous, *a, b, d, e*, the transverse, and D. E. the inferior processes.

*a, b, c, d, e, f*. the transverse division of these, similar to that in the crocodile.

Fig. 4. A vertebra from the tail of a young phocæna or porpoise; in which *a, b*. is an orbicular plate, united by means of cartilage to the body of the vertebra *a, d*. which is provided with such a one on both sides, *a, b*. and *c, d*.

Those bony lamellæ are the epiphyfes of the vertebræ, and are alike in all quadrupeds, to which class all the cetaceous fishes belong. When we consider the structure in general of these last, we find the hind legs only are wanting, and of course the ossa innominata; but the ossa pubis are very remarkable in all of them.

Fig. 5. Is a fossil vertebra of the unknown animal, whose bones are so often met with in St. Peter's Mountain at Maestricht,

tricht. A, B, C, D. is the body; C, I, K, E, F. the spinous processes; C, K, I. the medullary canal, running under K, E, F, in a direction parallel to IF, and coming out again at F. The remaining marks of the lamellated epiphyses I, D. and A, B. are evident proofs of the analogy between these and the vertebræ of the cetaceous fishes; and also of their want of resemblance to the vertebræ of the crocodile, as will appear by comparing the first and second figures with the fifth.

Fig. 6. Is a very accurate drawing of one of the fossil teeth belonging to the same incognitum. A B C. is its point, of a lanceolated figure, whose edges B A, and A C, are dentated; B C. is the root, uneven, bony, fixed within the socket with D, G, F.; D, G, B, C. is covered with the gums; H, I. is an oval sinuosity, in which generally the secondary teeth are generated, as is seen in tab. XVI. representing a fragment of the upper jaw-bone of the same incognitum, A, B, C, D, E.

The teeth in all the *Physeteres* and *Delphini* have solid roots, except in the young ones, in which they often have cavities to receive the blood-vessels and nerves. But the crocodile has the teeth intirely hollow, as appears in

Fig. 7. in which the cavity  $\Pi$ ,  $\Delta$ ,  $\Theta$ , shews the difference between the crocodile's teeth and those of the cetaceous and other fishes. This tooth is the anterior one of a large head of a crocodile, two feet long, and of the same size as that in the British Museum. A hollow tooth may notwithstanding belong to a *Physeter*, as Dr. OTHO FABRICIUS observes in his *Fauna Groenlandica*, p. 44. when speaking of the *Physeter microps*: of which he says, "*Habet in maxilla inferiori dentes*

22, utrinque 11 arcuatos, falciformes, *intus ad apicem usque cavos*," within they are hollow to the very end.

## T A B. XVI.

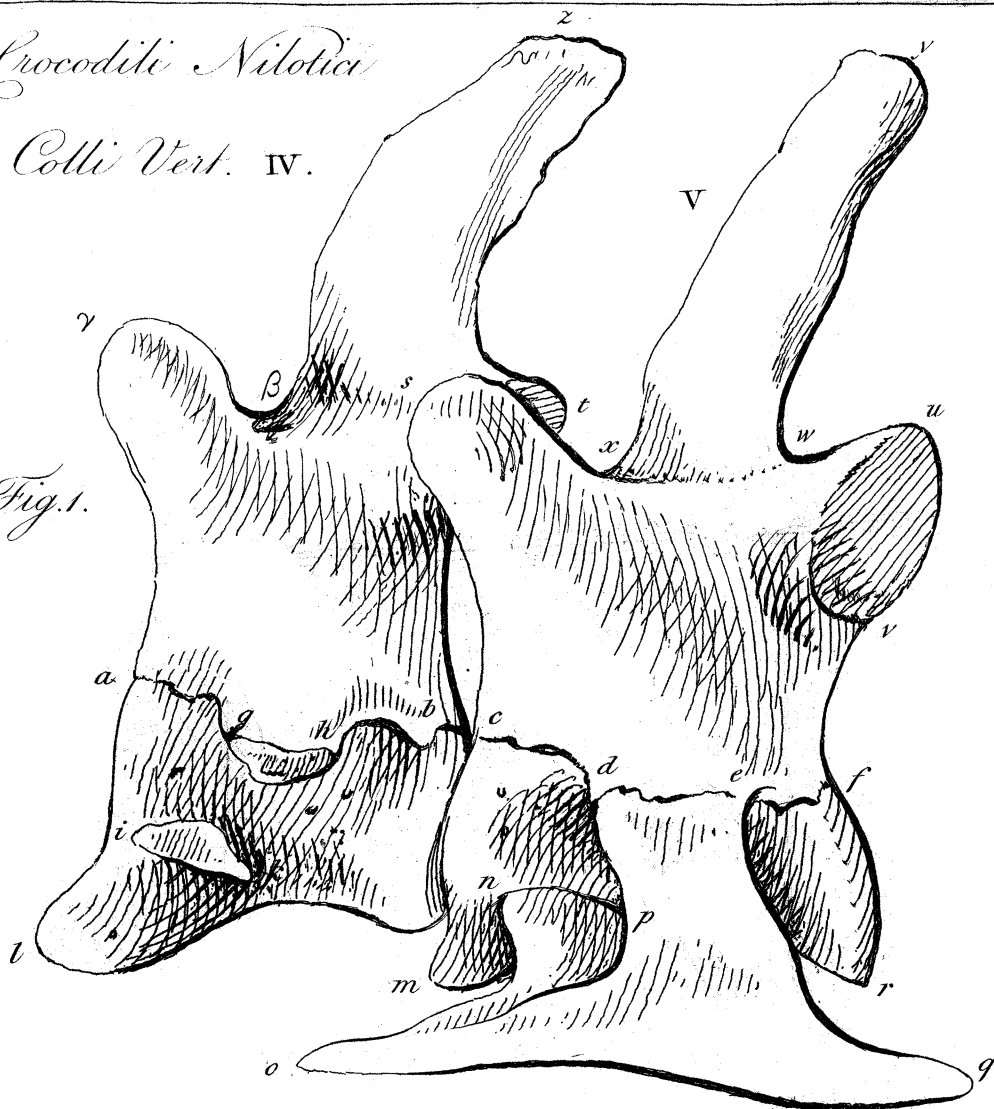
Fragmentum Maxillæ superioris, lateris dextri capitis Physteris incogniti, ex Monte St. Petri, Traj. ad Mosam. Origo dentium serotinorum ex ipsis radicibus solidis primo enatorum in quinque manifesta est. Quæ ad dentitionem hanc singularem pertinent, ex figur. 2. Tab. Fragm. similis sed Maxill. inf. 12 Aug. 1784. peti debent.



*Crocodili Nilotici*

*Colli Vert. IV.*

*Fig. 1.*

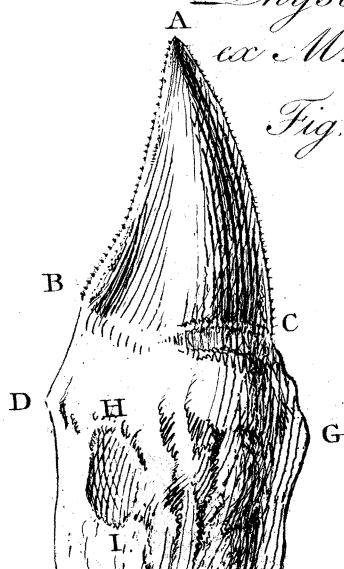


*Fig. 2.*



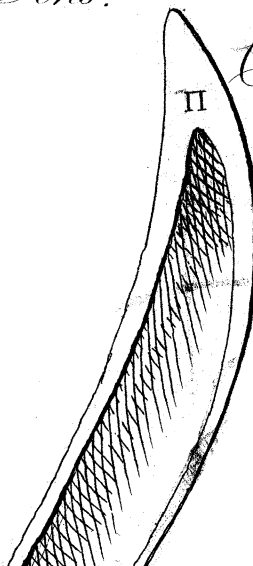
*Physet. Incogn. Dens.*  
*ex M. S. Petri.*

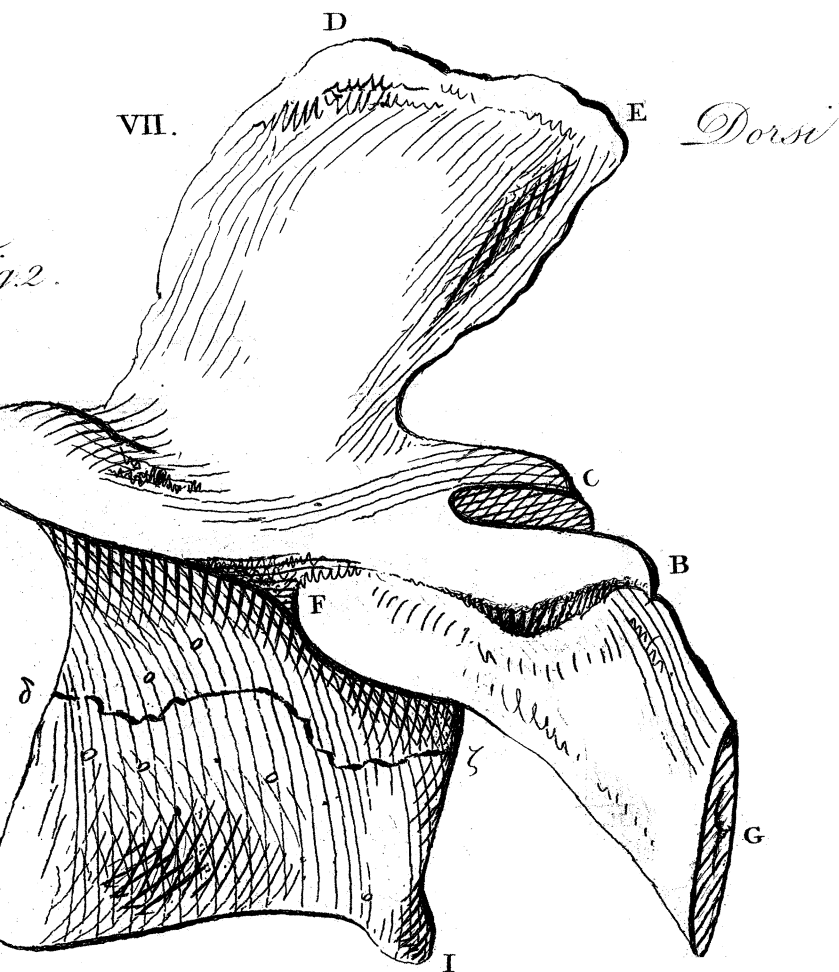
*Fig. 6.*



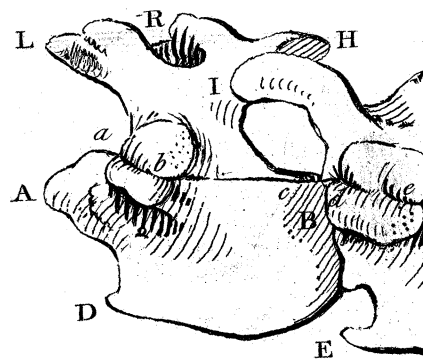
*Crocodili Dens.*

*Fig. 7.*



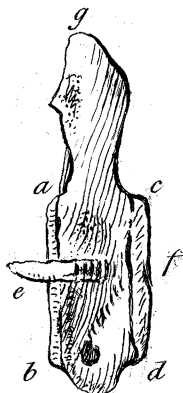
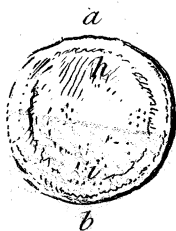


*Testudinis Ma*  
*Vertebrae e*  
*Fig. 3.*

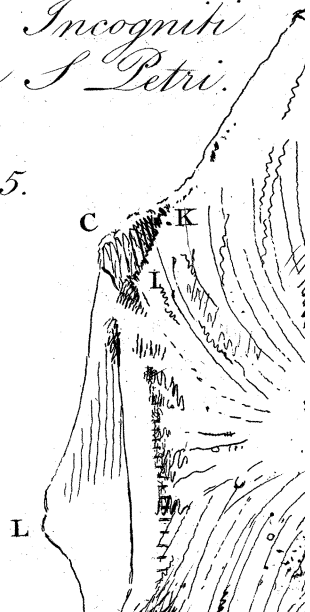


*Physeteris Incogniti*  
*ex Monte S Petri.*

*Fig. 4.*

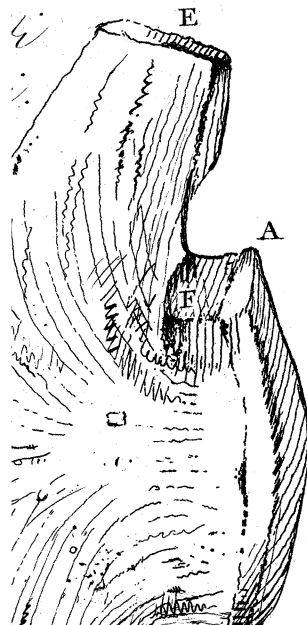
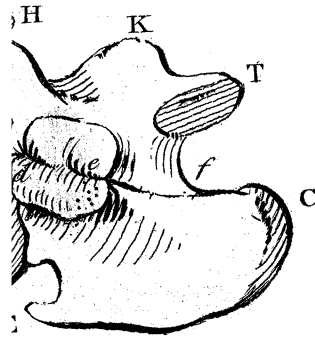


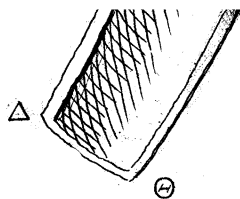
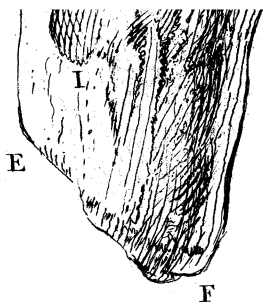
*Fig 5.*





*Marinae*  
*e Collo.*  
v.3.

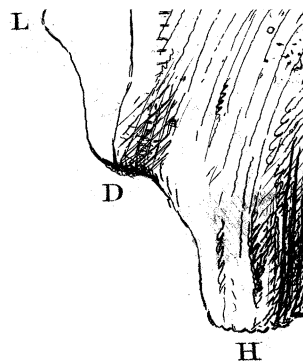


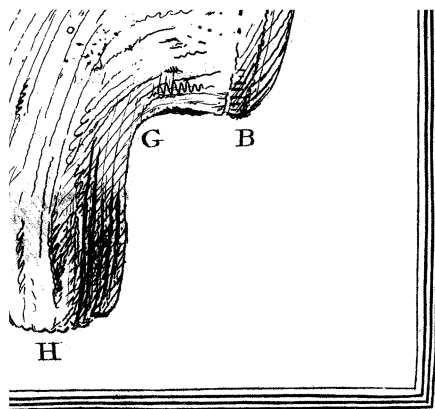


*P. Cämpfer f. Lancumi, 15 Junii, 1786.*



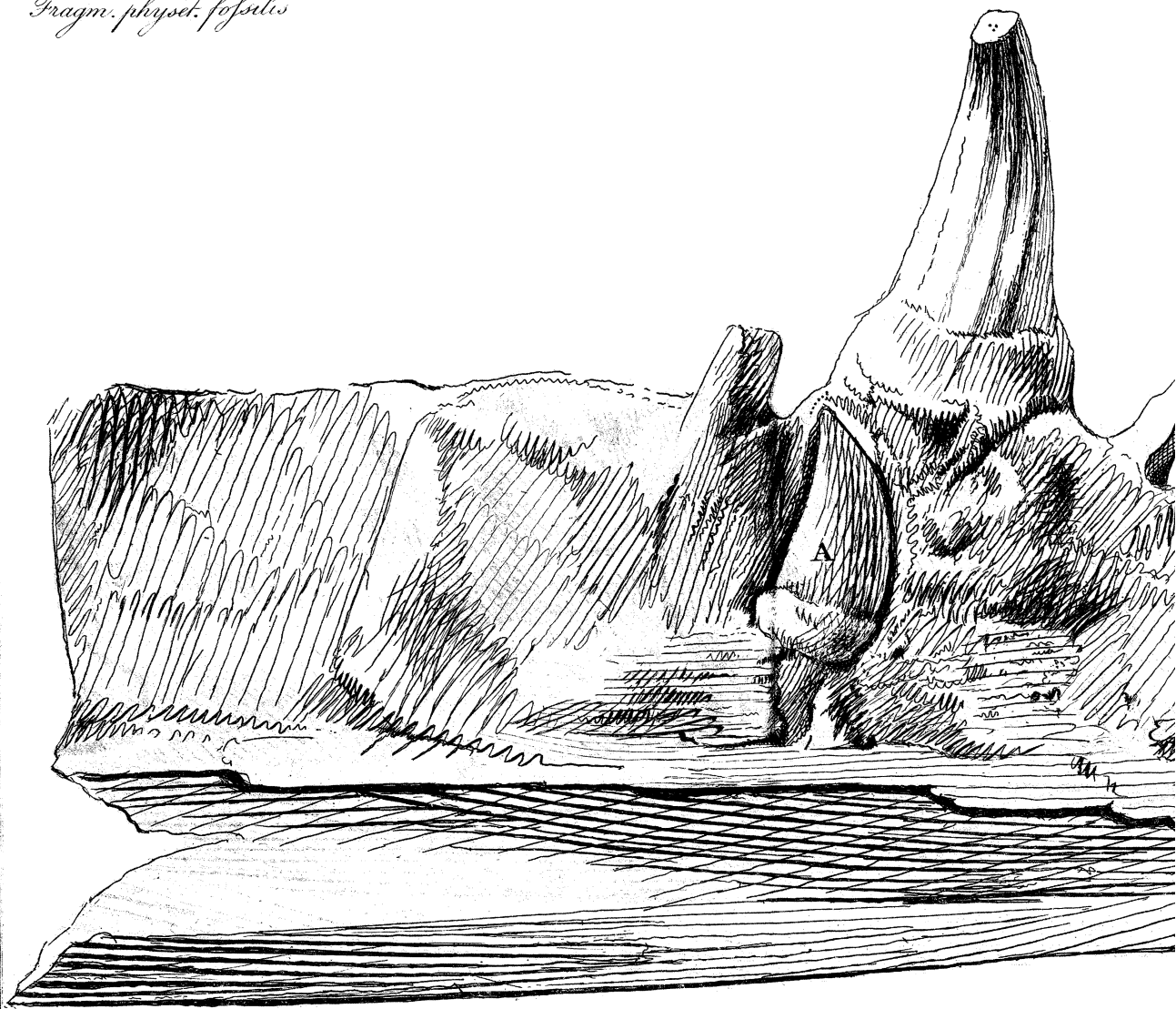
*Vertebra e cauda Phocaenae  
Junioris.*



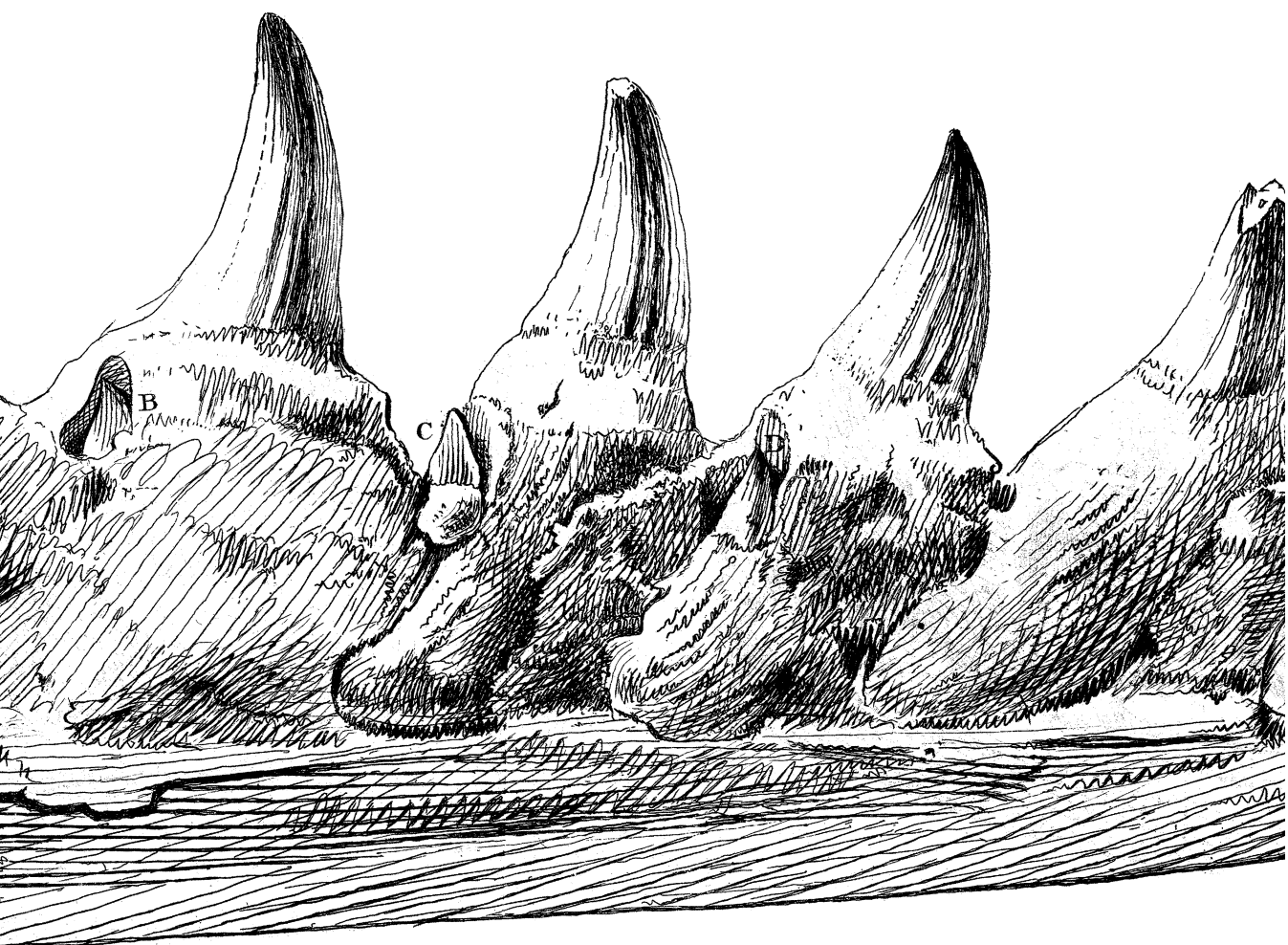


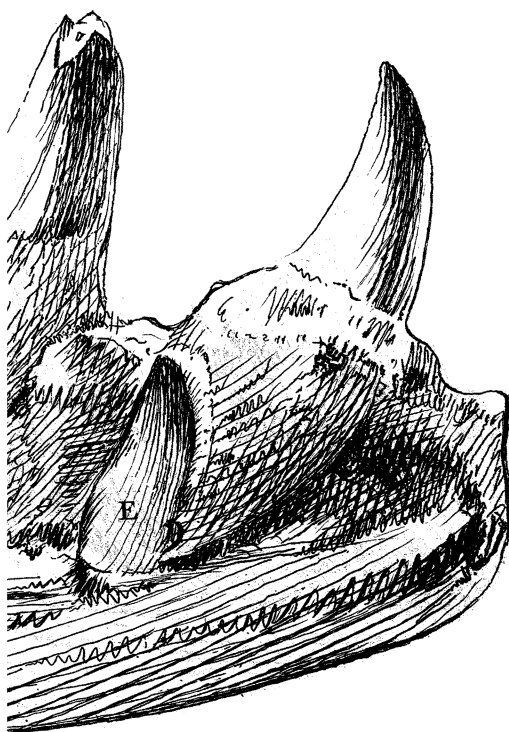
*Before S.*

*Fragm. physet. fossilis*



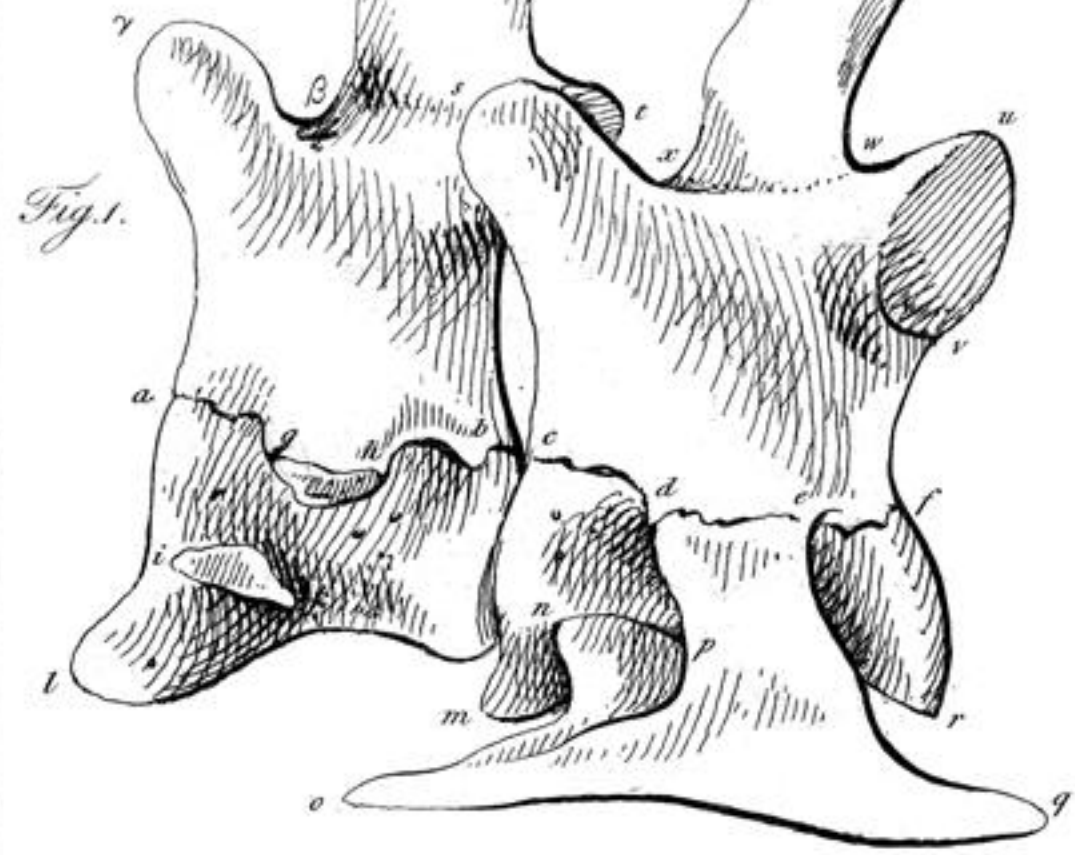
*Ex Museo Petri Camper*





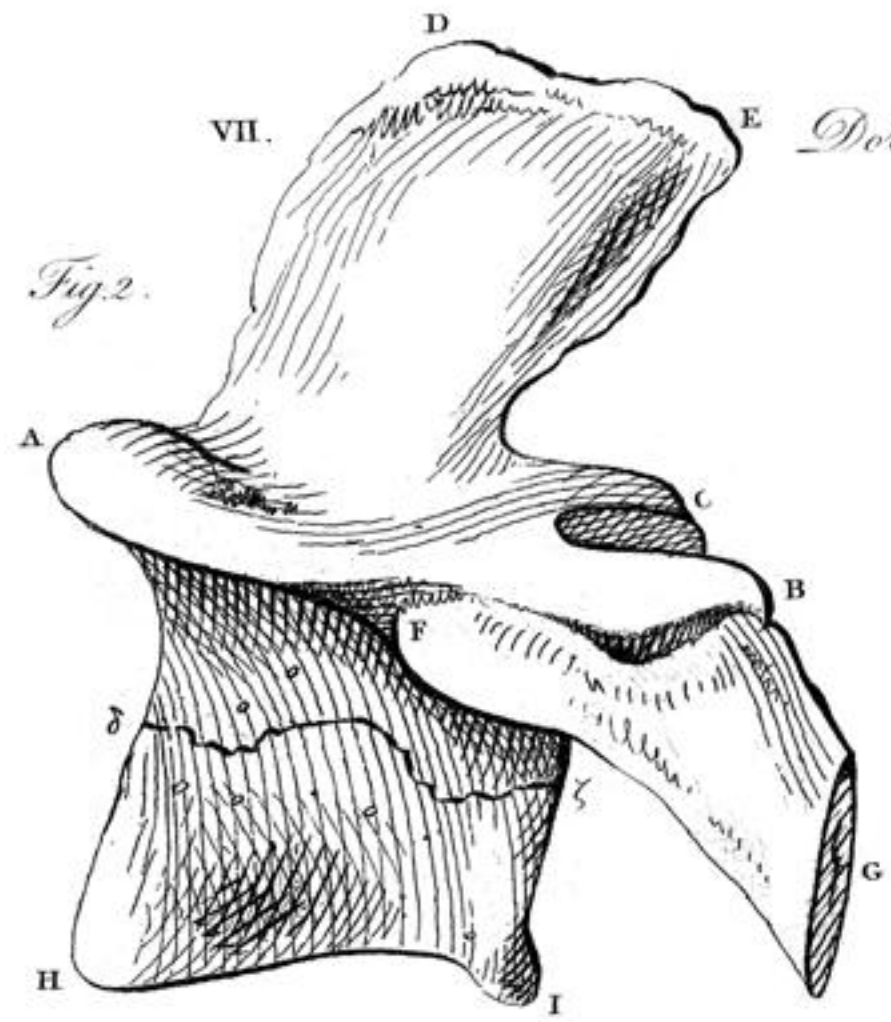
*P. Camper f*  
*Lancum 27 Maji*  
*1785.*  
*magnit. natur*

*Crocodili Nilotici*  
Colli Vert. IV.

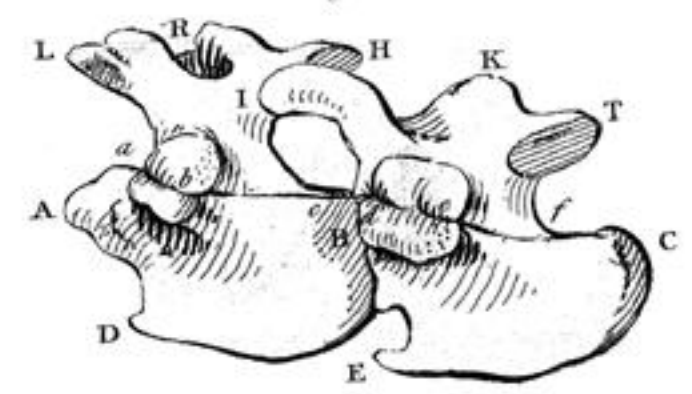


VII. *Dorsi*

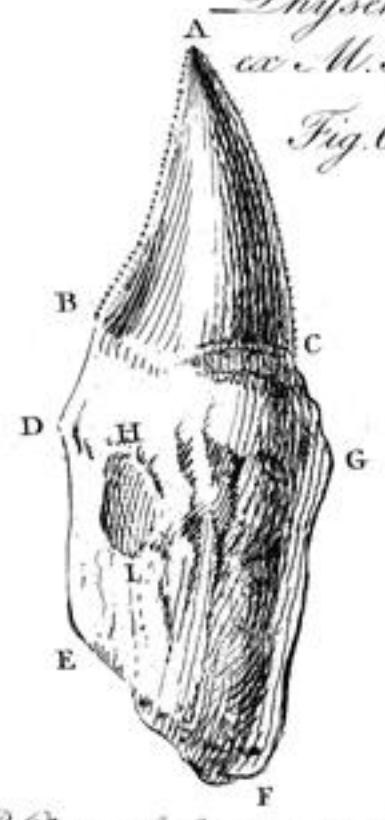
Fig. 2.



*Testudines Marinae*  
Vertebrae e Collo.  
Fig. 3.



*Physet. Incogn. Dens.*  
ex M. S. Petri.  
Fig. 6.



*Crocodili Dens.*  
Fig. 7.

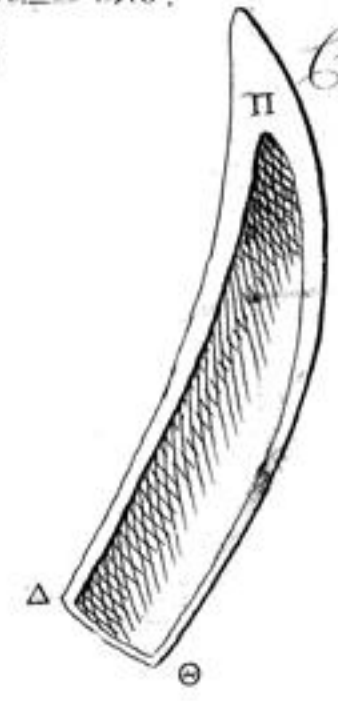


Fig. 4.

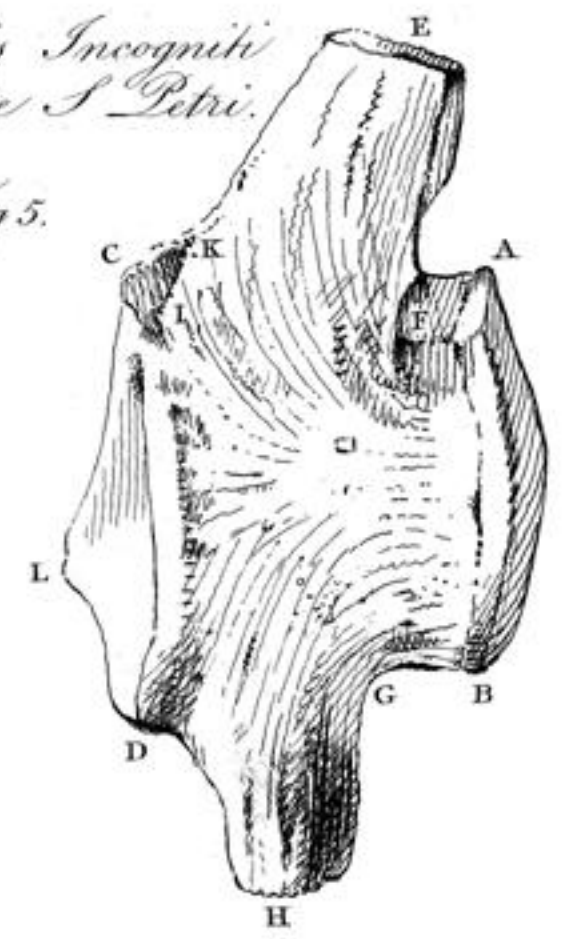


*Vertebra e cauda Phocaenae*  
*Junioris.*



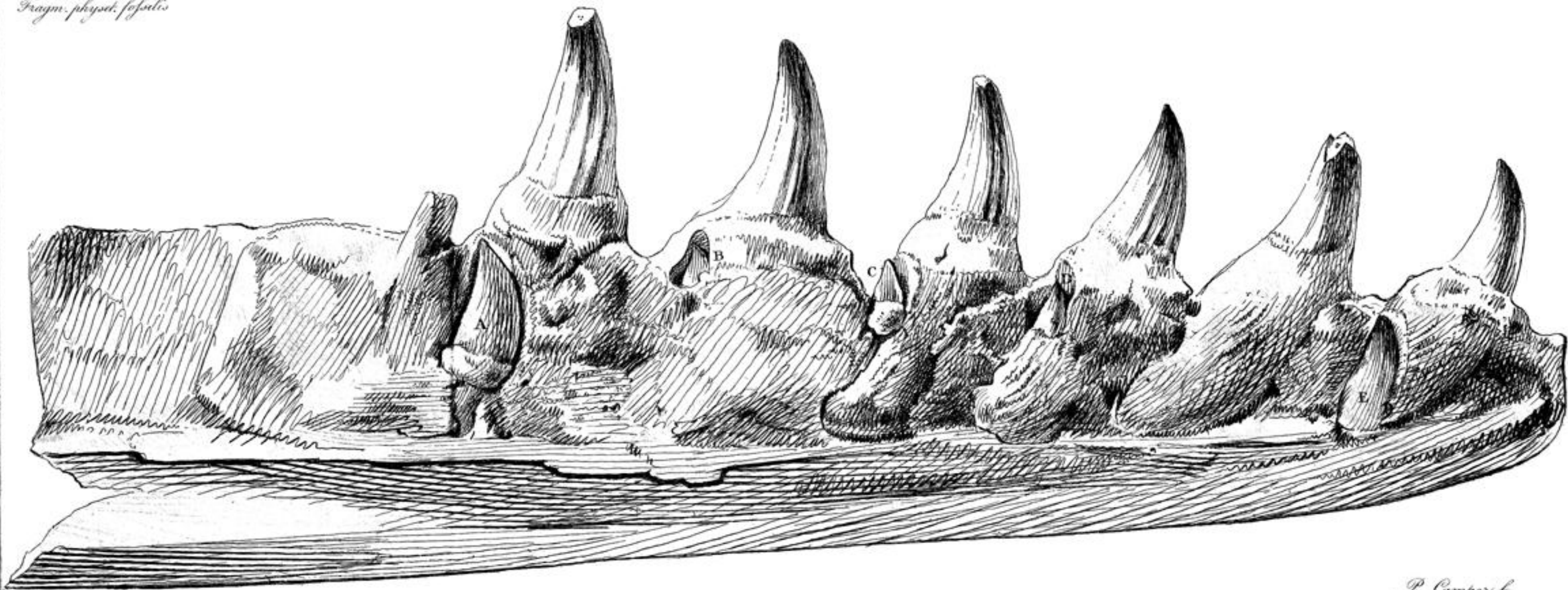
*Physeteris Incogniti*  
ex Monte S. Petri.

Fig. 5.





*Fragm. physiol. fossilis*



*Ex Museo P. Camper*

*P. Camper f  
Lancum 27 May  
1785.  
magnit. natur*