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The Sirenia of the Mediterranean Tertiary formations of Austria

by

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III. Description.

Metaxytherium petersi Abel 1904.

Synonymy:

1867. *Halitherium cordieri*. K. F. Peters, Das *Halitherium*-Skelett von Hainburg. (*Halitherium cordieri, Christol spec. [Manatus cuvieri ou fossilis, Blainv.; Hippopotamus medius cuvieri var.].*) Jahrb. D. k. k. k. geol. R.-A. XVII, 1867, p. 309–314, Pl. VII.

1882. *Metaxytherium spec.* R. Lepsius, *Halitherium schinzi*, die fossile Sirene des Mainzer Beckens. Abhandl. D. Mittelrhein geol. Ver., Darmstadt, vol. I, issue 2, p. 165.

1893. *Metaxytherium spec.* K. A. v. Zittel, Handbuch der Paläontologie. Vol. IV, 1891–1893, p. 198.

Geological Distribution:

Second Mediterranean stage.

Geographic Distribution:

Known only from the interalpine depression of the Vienna Basin, (Eggenburg, Neurdort on the March, Mannersdorf in the Leitha Mountains, Wollersdorf near Wiener Neustadt, Voeslau, Kalksburg, Perchtoldsdorf, Ottakring, Garschental near Feldsberg).

1. Skull.

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(Neudorf on the March)

A very incomplete fragment of the posterior section of the roof of the skull including a portion of the left parietal and the uppermost section of the supraoccipital is all that represents the skull of *Metaxytherium petersi* of Neudorf. Considering the thinness of the bones these remains belonged to a young animal.

It is very noticeable that in spite of the thinness of the bones of the skull, the width of the roof of the skull is almost exactly the same as in a skull of a full-grown individual of *Metaxytherium krahuletzi* from Eggenburg. The size of the supraoccipital is only 8 mm under the superior linea nuchae. The width of the roof of this skull is nearly as great as the width of the roof of the skull of the same species from the "Muschelsantsteine" of Wuerenlos (Kanton Aargau). It is 77 mm while the width of the roof of the skull of Eggenburg is 94 mm. Nevertheless the supraoccipital of the last-named form is 21 mm thick along the suture of the exoccipital.

Even though, as has already been mentioned, the roof of skull is in a very fragmentary condition, nevertheless the width can be certainly ascertained since the median line of the skull is marked by two parietal foramina (for the passage of blood vessels). In the sagittal section these are located closely behind one another.

There is no reason for assuming that a mature *Metaxytherium petersi* had a much broader skull than *Metaxytherium krahuletzi*, simply because the skull-remains of a young individual of *Metaxytherium petersi* has considerable width. On the contrary one can observe in young specimens of the dugong as well as numerous skulls of young mammals having the quadratojugal, that the skull in the immature state is very broad and that only upon advanced growth the temporal edges migrate higher upon the skull. Therefore the width of the roof of the skull cannot accurately be given for a mature *Metaxytherium petersi*. However, it did not necessarily reach or even begin to reach beyond the width of the roof of the skull of *Metaxytherium krahuletzi*.

As mentioned previously the same reason speaks also against considering the roof of the skull of the sirenian of Perg (according to Toula, *Metaxytherium*? *pergense* Toula) as belonging to the genus *Metaxytherium*. In this young animal the quadratojugals stand close to one another and with further growth would certainly not have become again further separated. In *Halitherium* the quadratojugals are close to one another, and since the dentition of the sirenian of Perg belongs to a type (species) of *Halitherium* it follows that this sirenian must not be placed with *Metaxytherium* but rather with *Halitherium* (compare page 28).

With the consideration of the minor morphological significance of this fragment a more accurate description of the skull-remains of *Metaxytherium petersi* may well be withheld.

2. Lower Jaw.

The only lower jaw remains of *Metaxytherium petersi* known heretofore were found together with remains of the vertebral column and numerous ribs in Baumann's sand pit in Ottakring XVI district Vienna. These remains represent only the right ramus which had not yet fused with the one from the left side. These remains must have belonged to a young individual as is shown also by the measurements of the skeleton.

In favor of the youth of this individual it is of significance that the symphyseal region does not descend steeply to the anterior but that it descends relatively straight. This condition can be observed on the lower jaws of young specimens of *Halitherium schinzi* (R. Lepsius, *l.c.* page 78). In mature animals the alveoli for the incisors are located on a flat area; in the lower jaw from Ottakring they converge on a sharp corner.

The pars horizontalia of the lower ramus reaches a length of 200 mm, consequently it can be very well compared with the lower jaw of *Halitherium schinzi* measuring 190 mm described by R. Lepsius.

The foramen mentale is very widely opened, the aperture 17 mm in diameter and about 60 mm. from the anterior margin of the jaw. Numerous other small canals may be furthermore observed which emerge in front of and underneath of this large opening.

The condylar process is very strongly damaged; the posterior border of the ramus of the lower jaw is rather straight.

The smallest width of the ascending ramus is 54 mm, the smallest height of the condyle (horizontal bar) 52 mm, and the greatest height in the symphyseal portion is 65 mm..

The symphyseal area is large, oval in form 60 mm long and 46 mm high.

The articular process lies deeper than the coronoid process.

The only tooth present in the ramus must be considered as the germinal tooth of the second molar; anterior to it was the first molar which had fallen out. The third molar which was still in the germinal chamber and which had not erupted yet, is lost.

Aside of the small size the form of the crown agrees very well with the molar from Mannersdorf of the Leitha Mountains although the latter is determined as the right lower M/4.

(compare plate 1, fig. 19). The outer walls of the crown are folded very strongly and covered with longitudinal wrinkles in a manner similar to the two transverse crests which bear numerous secondary cusps. The posterior talon appears as a simple dull cusp which is divided by a number of vertical slits. On the outer side of the crown the middle transverse valley extends nearly to the base so that the tooth appears very much like a molar of *Felsinotherium subapennium*.

An illustration of this specimen could not be reproduced in view of the fact that these remains have been strongly damaged especially in the ascending portion of the lower jaw.

3. Dentition.

a) Molars of the upper jaw.

(Neudorf on the March).

The "k.k. Naturhistorische Hofmuseum" has in its safekeeping a molar of the upper jaw of *Metaxytherium petersi*, which in spite of its very poor preservation shows some significant characteristics. The fragment displays only the anterior portion, the paracone, protoconule and the protocone. It can be shown that the protocone is the highest of the three cusps of the anterior main cuspal row. It shows that the protoconule is second in size and that the paracone is the shortest cusp. The paracone and the protoconule have each three sharp edges; two of these are on the anterior side and the other on the posterior side of the cusp. The first edge descends from the peak of each cusp against the anterior outer corner. This edge appears as a puffed area because of the depression to either side. The second edge descends towards the inside and the third edge which lies along the posterior side of each cusp descends again to the outer side. It follows then that each of the two cusps assumes the form of a three-sided, nearly equal-sided inclined or tilted prism.

The anterior cingulum does not appear in the form of a strong cusp wedged between the protoconule and protocone as in *Metaxytherium krahuletzi*, but rather as tilted incised comb, like in *Eotherium*, *Protosiren*, *Manatus*, *Halianassa*, *Halitherium* and others. It begins under the apex of the anterior wall of the protocone and ascends rapidly toward the base of the paracone. A furrow exists between the cingulum, and the apex of the protocone as in the molars of the upper jaw of *Manatus latirostris*.

The width of the tooth can not be given accurately since a large portion of the inner side of the protocone is lacking. It is probable that we here have the germinal tooth of the next to the last molar of the right upper jaw. It is very significant that this tooth is very primitive in the

development of the cingulum and shows itself much more primitive than the upper-jaw molars of *Metaxytherium krahuletzi*. In the latter the anterior cingulum has developed into a cusp which is posteriorly wedged between protocone and protoconule. It practically separates protocone and protoconule and in this manner it forms a transition toward the merging of the anterior cusp arising from the cingulum with the protocone. This condition is found in *Felsinotherium forestii*. This is a proof that *Metaxytherium petersi* can not be a descendant of *Metaxytherium krahuletzi*. Later we shall enumerate many other points which prove and point out the same, namely that the *Metaxytherium* species of the interalpine Vienna basin is not descended from the species of *Metaxytherium* from the outer alpine basin.

b) Molars of the lower jaw.

1. Second left lower molar.

(Garschental in Lower Austria]

The "k.k. Naturhistorische Hofmuseum" in Vienna has in its possession an anterior lower left molar from the lower jaw of *Metaxytherium* from Garschentel near Feldsberg in lower Austria. It appears to belong to the same species as the rest of the remains from the interalpine Vienna basin. The tooth is strongly damaged. A portion of the anterior outer cusp is lacking and the crown is preserved only along the lingual wall of the anterior inner cusp. It reaches here a height of 11.5 mm; this does not correspond to the full height of the crown since the crown has been ground down by use. The down grinding has also attacked the two inner cusps, however, the two transverse main ridges have not been ground down to the point where they show the characteristic hour-glass pattern, as is usually the case with the molars of the lower jaws of Tertiary sirenians. The posterior talon has two cusps and is divided by a deep longitudinal split or gash; both cusps of the talon are slightly ground or worn on the apex.

The slopings of the cusps are covered with rills (rifles) and strong wrinkles namely in the middle transverse valley. In spite of the rounding off which the tooth has suffered by the shore sediments of the second Mediterranean stage it can be nevertheless perceived that there were numerous auxiliary cusps and enamel-folds on the surfaces of the transverse rows. Consequently such a tooth in an unworn or unreworked condition must have had a similar complex structure-like those last lower molars which shall be discussed later. This tooth is 24 mm long; along the

anterior wall there is an interstitial wear surface which is not present on the posterior wall of the tooth.

2. Third (next-to-last) left lower molar (germinal tooth).

(Neudorf on the March.)

(Plate 1, fig. 16.)

Among the skull remains from Neudorf on the March, and now in the "k.k. Geologischen Reichsanstalt," there was found the germinal tooth of a next to the last left lower molar, which although not mentioned by K. F. Peters had been probably a long time in the collection. Only the enamel cap of this tooth has been preserved. The cusps have not been worn to the slightest degree. Along its anterior margin the tooth has a flattened place where it contacted the anteriorly located molar. Along the posterior margin it terminates with strong curvature.

The length of the crown is 21 mm, the width of the anterior ridge 18 mm, the posterior ridge 17.5 mm, the height of the protoconid 17 mm, and the metaconid 14 mm.

The anterior cuspal ridge is composed of the large anteriorly displaced inner-cusp (metaconid) which is connected by means of a depressed crescent-shaped loph to the anterior outer cusp (protoconid). This depressed crescent shaped loph bears a very sharp crest or comb which appears to be subdivided into a row of little cusps by means of numerous longitudinal folds. One of these is very large, it stands nearly in the median plane of the tooth and it is wedged in anteriorly between the metaconid and protoconid.

The metaconid descends to the transverse valley as a flat wall. Posteriorly the protoconid is divided by a furrow (fissure) ascending vertically from the transverse valley, into two cusps; the apex of the cusp is not reached by this furrow. The apex of the protoconid is "notched".

While the metaconid exceeds the protoconid in size, the hypoconid and entoconid are about equally developed. Two small secondary cusps which are about equal in size are wedged between the two main cusps. Posteriorly from the talon a smaller cusp pushes between these cusps. The two cusps which lie along the line of connection between entoconid and hypoconid nearly reach the height of these two cusps although they are of more slender construction.

The posterior talon, with the exception of the already mentioned small secondary cusp in the transverse valley between the posterior main cuspal ridge and the talon, is composed of three cusps. Of these latter ones the outer ones are the largest; in size this is followed by the middle one

and finally the inner cusp. The apices of these three cusps of the talon lie along a common line. This line trends from above on the outside to below on the inside.

As shown by the above measurements, this tooth has a much more quadrate form than the germinal tooth of the next to the last lower molar of *Metaxytherium krahuletzi*. In these two forms the posterior talon is developed quite differently in view of the fact that *Metaxytherium krahuletzi* has a very strong tritubercular talon having become a third cuspal ridge because of constriction of the middle posterior cusp.

3. Fourth (last) lower molar (germinal tooth)

(Neudorf on the March)

(Pl. I, Fig. 18; K. F. Peters, Das *Halitherium*-Skelett von Hainburg. Jahrb. d. k. k. k. geol. R.-A. 1867, XVII, Pl. VII, Fig. 2, p. 310)

This tooth which is kept in the "k.k. Naturhistorisches Museum" of Vienna comes from the sands of Neudorf. It is very well preserved. The crown of light-brown coloration is in sharp contrast to the orange-yellow roots, which constricted at the base of the crown had not yet closed. Both roots are strongly compressed anteroposteriorly and correspond in position exactly to the main cuspal rows. The anterior root still retains a height of 10 mm and the posterior one a height of 12 mm. The extended spectacle-shaped opening along the open lower margins has a length of 13 mm at the anterior root and a length of 10 mm at the posterior root.

The greatest height of the outer wall is 12 mm (at the hypoconid), that of the inner wall (at the entoconid) 9.5 mm.

The structure of the crown is unusually complicated since a great number of little secondary cusps are added to the main four cusps. Because of this it shows that *Metaxytherium petersi* is far more specialized than *Metaxytherium krahuletzi* from the first Mediterranean stage of the Vienna Basin.

On the anterior wall of the tooth there is a weak enamel fold on the outer corner of the protoconid. It represents the rudiment of the anterior cingulum which is better developed on the anterior lower molars. An anterior cingulum is likewise present on the anterior lower molars of *Halitherium schinzi*. It is lacking however on the last lower molar (Lepsius, *l.c.* p. 99).

The crown composed of two main cuspal rows has a talon, which having numerous projections, is attached posteriorly. The anterior row is composed of the two large main-cusps, the

inner one (metaconid) and the outer one (protoconid). Of the latter the outer wall is higher. The apices of these two main cusps are not simple any more but resolved into a number of prongs by incisions. Since the connection of the two cusps takes place by means of an equally strong incised transverse loph it is hardly possible to observe an exact distinction between the primitive main cusps and the secondary adjacent or auxiliary cusps. Therefore certain conditions come about which are also met with in the lower molars of *Felsinotherium subapennium*.

Along the posterior walls of the two main cusps which descend steeply against the transverse valley, there are two larger cusps which are separated by a medianly situated gash. This is also to be observed in the germinal tooth of the next to the last molar from Neudorf on the March.

It is noteworthy that this germinal tooth of the last lower molar is characterized by a covering of the enamel layer of the crown by numerous wrinkles and folds. This leads to the building of very many new secondary cusps. At the same time the other germinal tooth of the last lower molar has far fewer wrinkles and folds in the enamel and shows therefore a more primitive appearance. This complication is namely developed on the anterior main cuspal row. On it the apices of the cusps, because of incision which extends deeply, can be hardly differentiated from the newly developed secondary prongs.

The transverse valley between the anterior and posterior main cuspal row is deepened ditch-like behind the protoconid and the metaconid.

The posterior main cuspal row is made up of entoconid and hypoconid. The apex of the entoconid has remained simple but that of the hypoconid has become dual pronged because of incisement. A little anterior to the one of connection of the main cuspal apices there are two larger secondary cusps. These are separated from one another and from entoconid and hypoconid by means of deep fissures. Their surface is very strongly folded and wrinkled. Very small enamel peaks branch off from these and they suggest incipiency of new secondary cusps.

The secondary cusp which is fused to the hypoconid and is in the second transverse row is higher than the hypoconid. The one which is fused to the entoconid is about the same height as the hypoconid but shorter than the entoconid. In this tooth of *Metaxytherium petersi* the secondary cusps lose almost entirely their character of accessory constituent of the crown. In this manner they form the transition of *Metaxytherium petersi* of the second Mediterranean stage to the species of *Felsinotherium* of the third Mediterranean stage in northern Italy.

The oblique position of the transverse loph relative to the anteroposterior axis or direction of the tooth can still be recognized. It is however not developed so noticeably as was the case with *Halitherium schinzi*.

The posterior talon is composed of a section which nearly semicircular in form protrudes strongly posteriorly. It is made up a slender high outer cusp and a thick short inner cusp. In the depression between these two cusps and the two secondary cusps of the posterior transverse valley there are two little cusps close behind one another.

The length of the tooth is 23 mm, the width of the anterior loph or ridge 18.5 mm, that of the posterior ridge 18 mm.

4. Fourth (last) right lower molar.

(Neudorf on the March)

(K. F. Peters, Das *Halitherium*-Skelett von Hainburg. Jahrb. d. k. k. k. geol. R.-A. 1867, Pl. VII, Fig. 1)

The very greatly worn tooth from the sands of Neudorf had already been placed on avail for Peters. He considered it as the next to the last molar of the lower jaw. Because of the shape of the occlusal surface of both "Hauptplatten" and the peculiar arrangement of the substances of the talon-like "Hinterlappen" it was supposed to correspond to the tooth figured by Blainville as *Metaxytherium cuvieri* Christ. (*Osteographie*, Lamantius, pl. IX).

Apparently Peters had overlooked the presence of an interstitial wearing-surface of the anterior wall of the crown which bears against the anterior molar, whereas the posterior end of the tooth showed no trace of contact with a more posteriorly situated molar. Such a surface is lacking on a germinal tooth of the next to the last molar. However it would have to be present without question on the anterior molar which is so advanced in the state of down-grinding. Because of this, this molar is the last one and as a matter of fact the last one of the right side as is also demonstrated by the position of the axes of the main-cuspal rows and the inclination of the occlusal or grinding surface.

This tooth is the largest molar which has become known from the sirenian of the interalpine basin. The length of the crown is 31 mm (not 29 mm as shown by Peters). The width of the anterior transverse loph 24 mm, of the posterior one 21 mm, and of the talon 16 mm.

Along the anterior wall of the crown the crescent-shaped surface facing the third molar attains a width of 13.5 mm and a height of 7 mm. The strongly worn crown reaches at the highest point a height of 9 mm (in the metaconid).

The flower-like pattern produced by wear includes anterior and posterior lophs, the two large cusps of the talon, the median and lateral ones are still separated, also the small medially situated prong between both of these. Therefore the talon appears tricuspid. This leads as in the first lower molar of *Metaxytherium krahuletzi* to the development of a third two-cusped loph from the posterior talon. The sirenian of the Horn basin differs however from *Metaxytherium petersi* by virtue of a more strongly developed third transverse row on the last lower molar. This occurrence is however not, as thought by Depéret, restricted solely to this species.

The thickness of the enamel layer is 2 mm. Above its base the crown is covered by a great number of irregular wrinkles and bands.

The tooth has double roots: the anterior root is broader and longer, its largest diameter being 16 mm anteroposteriorly. Its height is 35 mm and its greatest breadth (in the lower half) 24 mm. Below the crown the root is thickened in botroidal fashion. It is then imparted with a constriction becoming hollowed out on the anterior and lower side by means of a rather flat longitudinal trough which downwardly becomes deeper. It finally terminates in a rather longer and another shorter median peak. Both of these are strongly curved backward.

The posterior root is trigonal while a longitudinal raised area begins under the botroidal region close to the base of the crown. The longitudinal raised area continues to the apex of the tooth. A deep small and distinct canal strings through the root on the anterior side. This is a roof that, although the tooth has been strongly worn down, the pulpa has not been completely closed off.

The length of the posterior root which diminishes evenly to its end attains 33 mm. Its width 22.5 mm and its diameter anteroposteriorly 28.5 mm.

5. Fourth (last) right lower molar (germinal tooth).

(Mannersdorf in the Leitha Mountains)

(Pl. 1, Fig. 19)

There is a last right lower molar from this locality in the "k.k. Naturhistorisches Hofmuseum," which was correctly shown by Peters to be the first lower cheek tooth of the right

side. An illustration of this tooth is to be found in the publication by Peters concerning the *Halitherium* skeleton of Hainsburg (*Jahrbuch der k.k. geol. Reichsanstalt* 1867, Taf. VII, fig. 3). Peters erroneously gave Deudort on the March as the place where this tooth was found. The notes of Prof. E. Suess written at a much earlier time state explicitly that the locality is "Mannersdorf am Leithhagebirge" (Acqu. Post d. k.k. Hofmineralienkabinetts: Partschen 1860, XXVI. 20).

Contrary to Peters, R. Lepsius later described this tooth as a germinal tooth of the last upper molar (*l.c.* page 166). There is no doubt here that Lepsius is in error. This may be because he may not have had the tooth for investigation. The two main cuspal rows are built differently than in the case of all the upper molars of the Halitheriidae the *Metaxytherium* and *Felsinotherium* forms. This is the case since in each of the two rows there are only two large cusps as in all the lower teeth of the sirenians and since the secondary cusps are far inferior in size to these.

The most noticeable character of this germinal tooth which is excellently preserved (only the roots are lacking), is the presence of a very strong anterior cingulum which extends from the apex of the anterior outer cusp (protoconid) obliquely to the base of the anterior inner cusp (metaconid). This course of the cingulum is very noteworthy.

While a strong anterior cingulum is present in *Eotherium aegyptiacum* extending from the apex of the metaconid to the base of the protoconid the same structure is very reduced in *Halitherium schinzi*. On the first and the second molars this cingulum is still present as an oblique raised area. On the third molar it appears as a thin enamel peak at the anterior outer corner (at the base of the protoconid) while on the last molar it is entirely lacking. It is present on the other hand on the last lower molar of *Halitherium christoli* from Linz, Wallsee and the Swabian Bohners of Melchingen, also on the last molar of *Metaxytherium petersi*.

A well pronounced cingulum on the last molars is to be found in *Metaxytherium krahuletzi*, *Metaxytherium petersi*, *Felsinotherium subapennium*, and *Felsinotherium forestii*. It does not extend from the apex of the metaconid to the base of the protoconid but instead from the apex of the protoconid to the base of the metaconid. This course of the cingulum is very apparent and we shall have to investigate whether or not the cingulum of *Eotherium*, which becomes progressively reduced in *Halitherium* and *Metaxytherium* is identical with or has a different origin than that of *Metaxytherium krahuletzi*, *M. petersi* and the two species of *Felsinotherium* which have a strongly developed cingulum especially in the last molar.

The cingulum in *Eotherium* and *Manatus* descends without exceptions obliquely from the apex of the metaconid to the base of the protoconid where it assumes its greatest size. It is natural that it appears there in the strongly reduced condition of *Halitherium* and *Metaxytherium* where it formerly was thickest. The main development of the anterior basal cingulum of *Metaxytherium krahuletzi*, *M. petersi*, *Felsinotherium subapennium* and *F. forestii*, lies however on the medial side whereas R. Lepsius speaks definitely of the lateral position of the anterior basal cingulum on the lower molars of *Halitherium schinzi* (Lepsius, *l.c.* page 101, figs. 33 and 34).

The remnants of the basal cingulum which for example we may observe on the lower molars of *Halitherium christoli* Fitz, from the Linzsands appear in the form of a rudimentary enamel peak at the base of the protoconid, in other words at the lateral apex. Since the basal cingulum of the last lower molar tooth of *Metaxytherium petersi* extends from the apex of the protoconid to the base of the metaconid it is here not a matter of an equivalent origin, but rather of a newly developed constituent of the crown.

That this viewpoint or argument is correct is clearly shown because at the same place where we see the last traces of the basal cingulum in *Halitherium christoli* Fitz, we can distinctly see on the last lower molar of *Metaxytherium petersi* from Mannersdorf a terminated enamel peak on the base of the protoconid which lies therefore on the lateral side of the crown.