

**Description of the skull of a species of Halitherium (H. canhami) from the red crag of Suffolk / by William Henry Flower.**

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DESCRIPTION of the SKULL of a SPECIES of HALITHERIUM (H. CANHAM) from the RED CRAG of SUFFOLK. By WILLIAM HENRY FLOWER, Esq., F.R.S., F.G.S., &c., Hunterian Professor of Comparative Anatomy, and Conservator of the Museum of the Royal College of Surgeons of England.

[PLATE I.]

WHILE looking, a few weeks ago, over the very rich collection of Crag fossils formed by the Rev. H. Canham, of Waldringfield, near Woodbridge, that gentleman called my attention to an unusually fine fragment of a skull, which he had been unable to identify with any known form. He very obligingly allowed me to bring it to London for the purpose of careful examination and comparison; and I have the pleasure of exhibiting it to the Society this evening.

The specimen was found in the so-called "coprolite" or bonebed at the base of the Red Crag at Foxhall, about two miles from Waldringfield; and it presents the usual aspect of the mammalian remains from that bed. It is heavily mineralized, of a rich dark brown colour, almost black in some parts, with the surface much worn and polished, and marked here and there with the characteristic round or oval shallow pits, the supposed *Pholas*-borings. Unfortunately, before it was extracted from the matrix in which it lay, it was broken by the pick into several pieces, some of which were lost by the workmen; but all that were preserved have been skilfully reunited by Mr. Canham.

The great interest of this skull consists in its affording the first recorded evidence of the former existence of an animal of the remarkable order Sirenia in this country.

The fragment consists of the anterior or facial portion of the cranium, which has separated, probably before fossilization, from the

posterior part at the fronto-parietal suture, and in a line descending vertically therefrom. This portion has then been subjected to severe attrition, by which the greater part of the premaxillary rostrum, the orbital processes of the frontals, and the zygomatic processes of the maxillaries, and other projecting parts, have been removed. In consequence of this, what may be called the external features of the skull, which are especially necessary to determine its closer affinities, are greatly marred, though enough remains of its essential structure to enable us to pronounce with confidence as to its general relationship to known forms. Fortunately the whole of the portion of the maxillæ in which the molar series of teeth are implanted is preserved; and though the teeth have fallen from the alveoli in the front part of the series, and in the posterior part are ground down to mere stumps, so that the form of the crowns cannot be ascertained in any way, many important dental characters may still be deduced from the number, form, size, and position of the sockets and roots that remain.

As the intensely hard ivory-like rostra of the ziphioid cetaceans, the tympanic bones of the Balænidæ, and the teeth of terrestrial mammals almost alone remain in these deposits to attest the former existence of their owners, it is doubtless to the extreme massiveness and density of the cranial bones, so characteristic of the order Sirenia, that we owe the preservation of so large a portion of the skull, under the very unfavourable conditions to which, in common with the other fossils of this formation, it must have been exposed.

A comparison of the fragment with the skulls of the two existing forms of Sirenia, the Manati (*Manatus*) and the Dugong (*Halicore*), gives the following results.

As regards size, the skull must have been considerably larger than that of either of those animals, as the following comparison of some of its dimensions with those of a full-sized American Manati and an Australian Dugong will show:—

	<i>Halitherium.</i>	<i>Manatus.</i>	<i>Halicore.</i>
Length of upper surface from fronto-parietal suture to posterior edge of anterior narial aperture .....	mètre. 0·115*	mètre. 0·095	mètre. 0·065
Height of skull from upper surface of frontal bones to lower surface of palate-bones .....	0·153	0·120	0·115
Width of skull in temporal fossæ, narrowest part .....	0·070	0·050	0·070
Width inside anteorbital foramina .....	0·095	0·062	0·058
Width between widest part of outer border of maxillary teeth .....	0·114	0·064	0·067

The posterior surface of the fragment (fig. 1) shows in its upper part the concave impression of the anterior cerebral lobes, with a

\* Something should be allowed for wearing of the edges of the bone to make the comparison exact.

deep median hollow; but the *crista galli* and the cribriform plates are broken away, giving full view into the nasal cavities, divided as usual posteriorly by a horizontal partition (*P.*) into an upper or "olfactory chamber" and a lower or "narial passage." The lateral portions of this partition formed by the palate-bones (*PL.*) still remain, but its central part, together with the whole of the vomer, has disappeared. In the middle of the roof of the olfactory chamber the upper part of the stout septum formed by the strongly ossified mesethmoid (*ME.*) remains; and a prominent longitudinal ridge (*ET.*) on the lateral wall, but preserved on the right side, is all that indicates the turbinals. The whole of the sphenoids and their dependencies and the pterygoids are broken away, the fracture extending through the bodies of the palate-bones, just behind the posterior molar teeth.

The upper surface (fig. 2) includes the whole extent of the frontals, except the antero-lateral processes which form the upper margin of the orbit, which have been worn away. It is probably also due to attrition that the general surface is evenly convex from side to side, instead of laterally ridged and flat or even concave in the centre as in the existing species. The anterior edge of this surface, forming the upper boundary of the anterior nares, is evenly arched, showing no median process as in the Manati, and to a less extent in the Dugong; but this may also be due to the wearing off of the thin part of the edges of the bones. A nearly semicircular suture an inch behind this margin appears plainly to mark off a distinct pair of nasal bones (*Na.*), joining each other in the middle line and therefore widely differing from their rudimentary or suppressed condition in recent Sirenians. But, as is well known, in some species of *Hali-therium* they are developed as conspicuously as in the present example\*. The size and form of the anterior nasal aperture (fig. 3) is characteristically Sirenian, and in its height compared with its breadth more like that of *Manatus* than *Halicore*. Its boundary on the right side by the ascending process of the præmaxilla (*PMx.*) is well seen; but on the left this is broken away; and, as before mentioned, the anterior boundary with the greater part of the rostrum has unfortunately perished. The floor of the cavity has precisely the same general form as in the recent Sirenians.

The lateral surface of the fragment (fig. 4) shows the inner wall of the anterior part of the temporal fossa, and of the orbit, the prominent margins of the last-named cavity and the zygoma being removed, and the great anteorbital foramen thus converted into an open groove. This region presents a striking difference of conformation from both of the existing genera. In *Halicore*, in the dried skull, there is a very large vacuity between the frontal and maxillary bones, connecting the orbital cavity with the nasal fossa. In the genus *Manatus* this vacuity is greatly reduced, the thin edges of the two bones, in the form of delicate paper-like laminæ, uniting more or less completely in different skulls. In the present fossil specimen

\* *H. Schinzi*, Kaup, 'Beiträge zur näheren Kenntniss der urweltlichen Säugethiere,' Heft ii. 1855, tab. ii. fig. 2.

the orbit is completely separated from the nasal fossa by a stout bony wall nearly an inch in thickness, across which the suture between the frontal (*Fr.*) and the maxillary (*Mx.*) can be clearly traced. What remains of the anterior root of the zygoma (*Zy.*) shows that this process must have been considerably more massive than in either of the existing species. The foramina of this region of the skull correspond generally with those of the Manati. Posteriorly several grooves run horizontally forward from the broken part of the skull; one of these (*a*) conducts the optic nerve to the orbit. Further forward, in the suture between the frontal and maxillary bones (at *b*) is a considerable-sized foramen (apparently accidentally enlarged on the right side) for the passage inwards of the palatine branches of the second division of the fifth nerve. In front of the anteorbital foramen, in the suture between the maxilla and ascending or nasal branch of the præmaxilla, is a foramen (*c*) which transmits the branch of the same nerve and the vessels which supply the horny plate, which doubtless existed on the under surface of the rostrum. This canal is again exposed (at *d*) in its course between the bones, by the destruction of the anterior extremity of the skull.

The inferior surface (fig. 5, two thirds natural size) shows the palate and sockets of the molar teeth. The former is elongated and narrow, as in the existing Sirenians, but rather broader posteriorly than in front. Its surface is quite flat, and rounded at the edges, owing to attrition. The posterior edge is concave in outline, but more evenly rounded than in either Dugong or Manati, in both of which a deep V-shaped notch exists in the middle line, entirely wanting in the present fossil\*. The suture between the palatine (*PL.*) and maxillary bones (*Mx.*) is very distinctly seen, the extent of the former being much the same as in the modern Sirenians. Near the middle line, just in front of the suture, are a pair of foramina, also found in the corresponding situation in *Manatus*; and further forward are several irregular foramina, which would indicate a considerable vascular supply to this part of the palate, as in the recent genera.

*Dentition.*—The number of maxillary teeth, as indicated by the alveoli, is six on each side, all placed in close contact with each other. The two most anterior have simple rounded alveoli about equal in size (0.017m. in diameter), indicating teeth with single cylindrical roots as in the Dugong, but differing in being rounded at the apex. The third appears to have had two roots, outer and inner, each rounded and smaller than those in front. The three following teeth resemble each other in form, though the most anterior or fourth of the whole series is rather smaller than the other two. They have three roots—one inner, compressed from side to side, and two supporting the outer border, each compressed from before backwards exactly as in the Manati. The general form of the tooth appears wider in proportion to its antero-posterior diameter than in that genus; but this is perhaps more apparent than real, as the minor root, as in the Manati, diverges considerably from the others, so that the deeper the section the wider the whole base of the tooth

\* The notch shown in the figure appears to be due to a fracture.

appears. The teeth, on the whole, are considerably larger in proportion to the size of the skull than in *Manatus*, as well as fewer in number, but differ still more fundamentally in presenting a distinction in character in the fore and hind part of the series, a division into simple premolars and more complex molars, if these terms can be correctly employed when we have no knowledge of a succession of the teeth.

It will be seen from the foregoing description that the specimen presents many characters common to the Manati and the Dugong, and others by which it differs from both, the most striking of them being the more normal development of the nasal bones and the outer wall of the nasal fossæ, and especially the dentition, in all of which it shows a more generalized condition. From *Rhytina* it is removed still further, as that genus is characterized by entire absence of maxillary teeth.

It will be necessary now to consider its relation with the extinct Sirenians of European Miocene and Pliocene deposits.

These are generally known collectively under the generic name *Halitherium*, Kaup, though several more or less marked subdivisions have been established. The genus is characterized by its founder, as far as the teeth are concerned, by having "two (as in *Halicore*) tusks in the steeply decurved præmaxillæ, and six tubercular molars with closed roots, increasing in size from before backwards"\* . Of the præmaxillary rostrum or tusks of our present specimen we know nothing; but the general characters of the molars certainly correspond with those of *Halitherium*. In that genus, however, there are two forms—one to which Professor Capellini has given the name of *Felsinotherium*, founded on a very perfect specimen from the Pliocene beds near Bologna† and including the French Pliocene species figured by Gervais as *H. Serresii*‡. From these the present specimen decidedly differs in the absence of the deep notch in the posterior edge of the palate, in the position of the anterior root of the zygoma, which rises from the maxilla opposite to the penultimate and antepenultimate molars, whereas it is much further forward in the above-mentioned species, and in the larger size and greater number of molar teeth, which do not appear to exceed five in either the Italian or French species assigned to this group.

On the other hand, it approaches more nearly to *H. Schinzi*, Kaup, from the Miocene of the Rhine valley, which appears to have had six molars, the first two having single roots. Comparing it, however, with Kaup's figures§ and with specimens in the British Museum, distinctions certainly of specific value can be seen, particularly in the superior size and massiveness of construction, in the form of the nasal bones and their relation to the upper ends of the præmaxillæ, the form of the hinder edge of the palate, and the greater size of

\* Beiträge zur näheren Kenntniss der urweltlichen Säugethiere. Zweites Heft (1855), p. 10.

† "Sul Felsinotherio." Bologna: 1872.

‡ Zoologie et Paléontologie Françaises, 2nd ed. (1859), pls. iv. v. and vi. *Op. cit.*

the molar teeth, both absolutely and relatively to the cranium generally.

Very few remains of Sirenians have hitherto been found in Belgium. My esteemed friend Professor Van Beneden has recently described and figured the much-mutilated occipital portion of a skull of an animal apparently of this order, to which he has given the name of *Crassitherium robustum*\*. It is obvious that there are no materials for instituting a comparison between this and our present specimen. M. le Vicomte Du Bus has given a preliminary notice of the discovery of the remains of a species of *Halitherium* in the clay at Boom, between Antwerp and Brussels†. But of the head unfortunately very little was found, and no detailed description has been published. And the same may be said of a nearly complete skeleton discovered by M. Lesseliers at Basel, near Rupelmonde, in the same neighbourhood, referred to in Professor Van Beneden's memoir quoted above.

A very thorough examination and comparison of all remains of extinct Sirenians scattered throughout the various continental museums must be made before their specific distinctions can be satisfactorily ascertained. It is quite possible that the present specimen might then be found to belong to one of the already-named species; but, as has just been pointed out, it presents characters in which it does not agree with any of those which are sufficiently preserved and well-described to admit of comparison. I think it will be most convenient to bestow upon it a specific designation, and therefore propose that of *Canhami*, to commemorate the assiduity with which its owner has collected, and liberally made available for scientific examination, the palæontological treasures of the neighbourhood in which he resides.

The subject of the origin of the very mixed fauna of the Red Crag bone-bed has been so frequently and ably discussed in the publications of this Society and elsewhere, that there is no occasion for me to enter into it at present. I would only remark in passing that the discovery of a *Halitherium* allied to the species found in the neighbourhood of Darmstadt is an additional instance to those already recorded of the existence in our Crag of forms characteristic of the Miocene fauna of the Rhine valley. It is also worthy of mention that Mr. Canham's collection contains three fine specimens of teeth of *Squalodon*, a form often found associated elsewhere with *Halitherium*‡. On the other hand, as showing the mixed nature of the fauna, there are from the same beds some beautifully preserved teeth of *Coryphodon*—one in particular, a last upper molar, very like, but rather larger than that figured by Hébert as *C. eocænus*, from the earliest Tertiaries of France§.

\* "Un Sirénien nouveau du terrain Rupélien," Bull. Acad. Roy. de Belgique, 2me série, t. xxxii. (1871) p. 164.

† Bull. Acad. Roy. de Belgique, 2me série, t. xxvi. (1868) p. 20.

‡ One of these is mentioned by Mr. Ray Lankester (Quarterly Journal of the Geological Society, vol. xxvi. (1870) p. 512). The others appear to have been added since.

§ Ann. Sc. Nat. 4me série, t. vi. p. 1.

## DESCRIPTION OF PLATE I.

- Fig. 1. Posterior surface of the fragment of skull of *Halitherium* from the Crag.  
 2. Upper surface.  
 3. Anterior surface.  
 4. Lateral surface.

All one third the natural size.

5. Under surface of the same, two thirds the natural size.

Letters in all the figures:—*Fr.* frontal bones; *Na.* nasals; *Mx.* maxillary; *PMx.* præmaxillary; *ME.* mesethmoid; *ET.* ethmoturbinal; *PL.* palatine; *Zy.* zygomatic process of maxillary; *P.* (in fig. 1) remains of horizontal partition separating olfactory chamber from posterior narial passages; *a, b, c, d* (in fig. 4), foramina for the passage of nerves and vessels; *M 1, 2, 3, 4, 5, and 6* (in fig. 5), sockets for the six maxillary or molar teeth.

## DISCUSSION.

Mr. PRESTWICH thought the specimen a most interesting addition to the derived fossils of the lower beds of the Red Crag. It was most likely derived from some of the Miocene beds which formerly existed, probably on what is now the basin of the German Ocean.

Mr. H. WOODWARD mentioned that in the Woodwardian Collection there was a skull of *Halitherium* from the Miocene of Darmstadt. It was, he thought, of great interest to meet with these Miocene forms in the Crag, most of the fossils of which appear to have been derived from the lower beds of the London Clay.

Dr. LEITH ADAMS mentioned the discovery of a tooth of *Halitherium* in a calcareous bed in Malta, where also he had discovered one of the ear-bones.

Mr. SEELEY pointed out that the skull presented some peculiarities, which made him doubt whether it could rightly be ascribed to *Halitherium*. He thought it might possibly belong to a new genus; at the same time he had noticed in the Crag deposits some vertebræ which he thought might be attributed to *Halitherium*.

The CHAIRMAN (Prof. Ramsay) was glad to find that so many geologists were disposed to regard the majority of the fossil bones from the Crag as derivative. He had long regarded them as belonging to a Miocene period, and probably a late one, and to a time when this country was united to the continent. When at the Crag period a portion of the surface was submerged, the neighbouring land might, however, have been still inhabited by the old Miocene fauna.





Fig. 5.



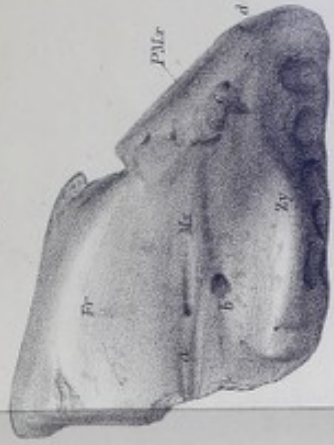
$\frac{1}{2}$  nat. size.

Fig. 1.



$\frac{1}{2}$  nat. size.

Fig. 4.



$\frac{1}{2}$  nat. size.

Fig. 3.



$\frac{1}{2}$  nat. size.

Fig. 2.



$\frac{1}{2}$  nat. size.

G.H. Ford & C.L. Greenbach.

HALITHERIUM CANHAMI.

Mantorn Bros. imp.

