

THE
GEOLOGICAL MAGAZINE.

NEW SERIES. DECADE III. VOL. I.

No. X.—OCTOBER, 1884.

ORIGINAL ARTICLES.

I.—NOTES ON SOME NEW CARNIVORES FROM THE BRITISH EOCENE FORMATIONS.

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(PLATE XV.)

THE remains of many genera and species of the Order Carnivora have been discovered in the Lower and Middle Tertiaries of the European Continent, and have been described and figured in numerous valuable palæontological works and memoirs by Continental authors. That these remains are exceedingly rare in the older Tertiaries of England is proved by the fact, that only one Carnivore, the *Hyænodon*,¹ has been placed on record as occurring in them.

There are, however, some imperfect remains of other genera, hitherto unnoticed, preserved in the National Collection (Natural History), Cromwell Road, South Kensington. These remains, although fragmentary, are interesting, as being new, and therefore worthy of record as additions to our scanty list of Eocene Carnivores. The most important is part of the head of a small animal about the size of a Fox (No. 30203), from the Eocene Freshwater Beds at Hordwell—whence the *Hyænodon* remains were also obtained—still partly embedded in the characteristic friable sandy matrix which has yielded remains of many vertebrates. It is obliquely crushed, and little besides the base of the skull, a maxilla, the mandibular rami and the teeth, upper and lower, are preserved. The exact form of the bones of the head is unknown; but the profile is fairly preserved in the matrix, those portions which are present being respectively in their natural positions, in regard to each other, we have almost accurate evidence of size, the length from the exoccipital condyles to the anterior margin of the canine being 4·7 inches.

The exoccipital condyles are entire, and portions of the basi- and pre-sphenoids are preserved, also the tympanic bullæ, but these are too crushed and imperfect to serve as aids to generic identification; a portion of the left maxilla and the rami of the lower jaw are preserved, fortunately having nearly the whole of the side teeth *in situ*. There are also portions of the atlas, axis and the third cervical vertebra, but too imperfect for comparison or measurement.

The mouth being closed when the skull was embedded, with the

¹ Owen, "Palæontology," 2nd edit. 1861, p. 372.

upper and lower teeth in close contact, and their outer surfaces only partially exposed, there was some uncertainty with regard to its natural position among the Carnivores, although supposed to belong to the Viverridæ. Having recently detached a portion of the right ramus of the lower jaw, and fully developed the last four molars of the maxilla and mandible from the enclosing matrix, this supposition is confirmed; for the upper carnassial and tubercular teeth closely resemble in form and structure the corresponding teeth in *Herpestes*; but are unlike the same teeth in *Viverra*, as represented by the existing species, *V. civetta* and *V. zibetha*; they are also unlike those of *Genetta*.

The maxillary teeth consist of three premolars, the carnassial (pm. 4), and two tubercular molars (m. 1 and m. 2). The combined length of the last four teeth of the maxilla is 1·05 inches.

The first premolar (pm. 1) is very small and placed close to the canine; pm. 2 is also small relatively to pm. 3; in *Herpestes* these teeth differ but little relatively to each other as regards size; pm. 3 is low-crowned, with a well-defined posterior accessory lobe and also a small inner lobule, always present in *Herpestes* and *Genetta*, but not in *Viverra*; it is, however, relatively smaller in the fossil. Its dimensions are: antero-posterior diameter 0·3; vertical diameter 0·2. The carnassial (pm. 4) accords in all essential characters with the corresponding tooth in *Herpestes*. The anterior lobe of the blade is conical and stout, the posterior lobe is relatively lower than in *Herpestes*, and has a sharp cutting edge, the internal tubercle is proportionally smaller; the anterior accessory lobe is also small. On the outer posterior base of the front lobe is an additional lobule, not very prominent, which intercepts the cingulum. This lobule is not present on the carnassial of any recent member of the family that I have examined. The dimensions are—

Antero-posterior diameter	0·43
Vertical diameter of anterior blade	0·27
" " posterior blade	0·16
Anterior transverse diameter	0·27

The first molar (m. 1) is large, tricuspid and triangular in form, outwardly it recedes obliquely backwards, the anterior transverse diameter greatly exceeding the posterior. The outer cusps are small and conical, the anterior cusp being the largest; they are separated from the inner cusp or talon by a deep depression, and from the outer margin or cingulum by a relatively broad and flat intervening space; hence the anterior cusp rises near the middle of the tooth transversely. The second tubercular (m. 2) is small and much compressed antero-posteriorly. The canines of either side are present, and in natural position relatively to the other teeth, but the apex of each is broken. One incisor, the third of the right side, is also present. The dimensions of the respective teeth are as follows:

Antero-posterior diameter of 1st molar	0·3
Transverse " " "	0·4
Antero-posterior " 2nd molar	0·10
Transverse " " "	0·25
Antero-posterior diameter of base of crown of canine	0·26

The left ramus of the lower jaw is nearly entire and *in situ*, the teeth being in contact with those of the opposing maxilla, the condyle is just within the glenoid cavity of the squamosal. The length is 3·4.

The detached portion of the right ramus contains the third and fourth premolars, and the first and second true molars. Premolar 3 is smaller relatively to premolar 4 than is the corresponding tooth in *Herpestes*, the base is broad in the direction of the long axis of the jaw, the crown is low, and there is a well-defined posterior tubercle; premolar 4 resembles the same tooth in *Herpestes*. We have, however, in the first molar (the carnassial) another type of tooth, distinct from *Herpestes*, but like the corresponding tooth in *Cynodictis*. The posterior lobe of the blade is acutely conical and high, the anterior lobe being relatively low, barely half the height of the posterior lobe, the inner cusp is also high and stout. In *Herpestes* the two lobes of the blade do not differ greatly in height and the inner cusp is relatively smaller, and less elevated than the anterior lobe of the blade. The talon has a central conical tubercle, and there is a small cingulum on the outer anterior base of the blade. The tooth is short antero-posteriorly, the length not exceeding the vertical height of the posterior blade. The second molar is proportionally small, it has three tubercular points and a short posterior talon, which is not shown in m. 2 in *Herpestes*, but is present in *Cynodictis*. The dimensions of the mandibular teeth are—

Antero-posterior diameter of premolar 3	0·27
Vertical diameter	0·15
Antero-posterior ,, premolar 4	0·35
Vertical ,, ,,	0·23
Antero-posterior ,, carnassial	0·37
Vertical diameter of anterior blade of ditto	0·21
ditto posterior ,,	0·36
Antero-posterior diameter of molar 2	0·21

Comparing the upper molars of our fossil, with the published figures of fossil Viverridæ, I find that in size and general character they most nearly resemble the *Viverra antiqua* of De Blainville,¹ a species founded upon a portion of a maxilla containing four teeth from the Miocene Freshwater deposits, St. Gérard le Puy, Allier. Gervais reproduces De Blainville's figure,² and accepts his determination of the genus. Pomel subsequently referred the fossil to the genus *Herpestes*,³ as he considered that the teeth indicated a transition from the Civets in the direction of the Genets. M. Filhol has more recently described and figured⁴ a very perfect skull, also from St. Gérard le Puy, which he refers to *Viverra antiqua*, and although he adopts De Blainville's generic appellation, he admits that in many points of structure it is distinct from any true *Viverra*, and that by its dentary system it is allied to *Genetta*; yet on the other hand he enumerates certain cranial characters that he considers indicate a still nearer relationship with the Civets than with the

¹ "Ostéographie," Genus *Viverra*, p. 71, pl. 13.

² "Zool. et Palæont. Franc." 1848-52, Explication, pl. 28, p. 11.

³ "Catalogue Méthodique," 1853, p. 64.

⁴ "Ann. des Sc. Géol." Paris, 1879, tome x. art. 3, p. 152, pl. 19.

Genets; he also quotes, in support of this conclusion, a work by M. Lartet, in which he describes certain differences in the form of the brain of *V. antiqua* and *Genetta*, founded on casts taken respectively from the fossil and recent skulls, that tend in the same direction. M. Filhol also remarks that the locality of St. Gérard le Puy contains numerous specimens of this mammal (*V. antiqua*); he knew of four nearly perfect skulls, but was not certain whether he had obtained the mandible, although he considered (*loc. cit.* p. 166) it highly probable that some mandibles described and figured under the name of *Herpestes* (pl. 24, figs. 5–9) might belong to the same species. This type of mandible is intermediate between *Viverra* and *Herpestes*, and accords therefore with the cranium. He has elsewhere figured and given a detailed description of a perfect ramus of a lower jaw which he refers to *Viverra* (*V. angustidens*, Filh.).¹ Describing the carnassial, he says, its anterior portion is formed of three points, more detached and more elevated than in any other living or fossil species of *Viverridæ*; it is succeeded by an elongated talon, not so large but more erect than in *Cynodictis*. The structure of the lower carnassial of the Hordwell carnivore corresponds in all particulars with the above description and figure of the Quercy tooth.

The conclusions of M. Filhol as to the generic position of the above-named fossils, derived from careful study and comparison of many fossil specimens with existing forms of *Viverridæ*, are important, as are also the reasons he adduces for considering them as representatives of an early and extinct form of the genus *Viverra*, differing in many points of dental structure from any existing species of the genus. They are also valuable as aiding us in determining the genus to which the Hordwell skull should be assigned; a matter of some difficulty, owing to the mixed character of the teeth, and open to objection to make, from so imperfect a specimen, a new genus for its reception.

The specimen has a local interest and importance; interesting as being the first instance recorded of a Viverrine carnivore from a British locality, and important as being the first placed on record in which the teeth of the upper and lower jaws have been found in natural association; also as having been found in a deposit, and associated with a fauna, of unquestioned Eocene age; it is therefore the earliest representative of the Family *Viverridæ* hitherto described.

The resemblance of the lower carnassial and tubercular molar to the corresponding teeth in *Cynodictis* indicates the close affinity of these older forms of Civets and Dogs, and also possibly points to a common ancestry. This affinity is more marked in species of *Viverridæ* described by M. Filhol,² in which the third lower molar is entirely suppressed or reduced to little more than a point.

¹ "Recherches sur les Phosphorites du Quercy," 1876, p. 144, figs. 121 and 122.

² "Ann. Soc. Sci. Phys. et Nat." Toulouse, 1882, pp. 56–62.

I propose the name of *Viverra Hastingsiæ* for this specimen, it having formed part of the large and valuable series of vertebrate remains from the Hordwell Beds collected by the late Marchioness of Hastings, which have long been preserved in the National Collection.

A second specimen, also from the same bed¹ of the Upper Eocene at Hordwell, is part of a skull of a much larger animal than the preceding, showing the palatal surface of the maxillæ and portions of other bones of the head, but too fragmentary for ready identification. A canine and three premolars in fair preservation, and one premolar and a carnassial with the crowns broken are present in their respective alveoli. (No. 36791.)

The maxillæ have parted at the median palatal suture, and that of the right side has slipped in advance of the left; notwithstanding this displacement, and some fractures, the size and form of as much as remains of the roof of the mouth is preserved. The length from the anterior margin of the canine to the posterior margin of the carnassial is 2·3, and the width of the palate between the third premolars is 1·3. No incisors are preserved, and the possession of a first premolar is indicated only by the preservation of part of an alveolus. The canine has a broad, and relatively to the crown, large fang; its antero-posterior diameter being 0·58, and that of the base of the crown 0·4. The second premolar is conical, with the anterior margin vertically convex, and the posterior margin vertically concave and sharp-edged, and there is a well-defined cingulum on the inner side. The dimensions are antero-posteriorly 0·45, and the posterior transverse diameter 0·2. The summits of all the teeth being worn, vertical measurements have not been taken.

The third premolar has a large posterior lobe with the point abraded by use, and an inner cingulum terminating in a small lobule at the inner posterior base of the crown; the dimensions are antero-posterior diameter 0·5, and transverse diameter 0·25. The carnassial (pm. 4) relatively to premolars 2 and 3 is a small tooth; its antero-posterior diameter being 0·55 and the transverse diameter 0·43. The summit is too much broken for description, but the hinder talon is intact and small. The only evidence of a tubercular molar are the alveoli of the two outer fangs of m. 1, one empty, the other containing the fang *in situ*; there is no indication of a third or inner fang; the second molar if present was small. The incompleteness or absence of these characteristic and important teeth, together with the fragmentary condition of the few bones of the head present, renders it almost impossible to determine accurately the genus to which the fossil should be referred. The parts that remain do not correspond with the same parts in any Eocene carnivore that I have been able to compare it with, either by drawing or actual fossil.

The specimen was collected and presented to the National Collection with other fossils from Hordwell in 1862, by Samuel Laing, Esq., M.P., F.G.S.

¹ Bed No. 15 of Messrs. Tawney and Keeping's section of the Hordwell Cliffs, Quart. Journ. Geol. Soc. vol. xxxix. p. 571.

We have thus evidence that when this freshwater bed at Hordwell was being deposited, there existed three terrestrial carnivores of fairly large size that preyed on the Anoplotheres, Paloplotheres, Dichodons and other herbivores, and the smaller Microchæres and rodents (*Theridomys*) that abounded on the land bordering the old inland lake in which these deposits were laid down.

The third specimen is also a mutilated skull of an animal a little larger than a Fox from the London-clay at Sheppey (No. 35688). Portions only of the parietals, the maxillæ and palatine, and of the pterygoids and presphenoid are present. And like most of the fossils from Sheppey, the specimen is not crushed or distorted, and imperfect as are the parts preserved, as much as remains of each bone retains its natural form and position.

The most perfect bone is the right maxilla; the teeth are all wanting, only the alveoli of the third premolar, the carnassial and the first molar are shown. The carnassial was a short tooth relatively to its breadth; the antero-posterior diameter of the alveoli of the outer fangs being 0·45, whilst the transverse diameter across the alveoli of the posterior and inner fang is 0·4. The anterior margin of the alveolus of the inner fang being in a line with that of the posterior fang in the direction of the transverse diameter of the palate, indicates the triangular form of the tooth. That the first molar was a large and powerful crushing tooth is shown by the size of the alveolus of the fang of the talon. The second molar, if present, must have been very small; there is no indication of its presence, and from the state of preservation of the posterior portion of the maxilla, it is a question if it possessed one. The posterior palatal foramina are shown, and also the infraorbital foramina just above the carnassial alveoli.

In the absence of the teeth, and the imperfection of the bones, there are no definite characters by which to correlate it to any extinct form, nor to indicate the family to which it should be referred. I therefore propose to name it *Argillotherium toliapicum*.

In conclusion, I may observe that during the many years in which I have known and felt an interest in the specimens here described, I have never seen in any private or public collection a fragment of a tooth or bone of a carnivore from Sheppey, except the fragment here noted; and only a few detached teeth, mostly referable to *Hyænodon*, from Hordwell. Specimens may be lying hid in private collections, and if such there be, I trust these imperfect notes may have the result of directing attention to them.

EXPLANATION OF PLATE XIV.

Viverra Hastingsiæ, Davies, sp. nov. From the Eocene Freshwater Beds of Hordwell, Hampshire.

FIG. 1. Outer side view of anterior portion of the head and teeth; and of the inner side of the left mandibular ramus.

FIG. 2. Crown view of the upper teeth.

FIG. 3. Outer view of the detached portion of right ramus of the lower jaw; the parts wanting are restored in outline.

FIG. 4. Crown view of the lower teeth.