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On some Fossil Reptilian and Mammalian Remains from the Purbecks

Owen

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Notes

1. *On some* Fossil Reptilian *and* Mammalian Remains *from the* Purbecks. By Professor Owen, F.R.S., F.G.S.

The fossil remains which form the subject of the following descriptions were kindly transmitted for my examination by W. R. Brodie, Esq., and Charles Willcox, Esq., of Swanage, by whom they were discovered—the mammalian fossils exclusively by Mr. Brodie—in certain members of the Purbeck formation at Durdlestone Bay, near that town.

I propose to commence with the reptilian fossils, and first with those transmitted by Mr. Willcox, to whom I owe opportunities of describing many rare and interesting remains from the rich locality which he has so successfully explored.

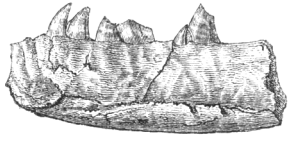
Class REPTILIA.

Nuthetes* destructor, Owen.

The specimen (figs. 1, 2, 3, & 4) on which this genus and species is founded is a portion of the left ramus of the lower jaw, with seven more or less perfect teeth, of a Pleurodont Lizard, allied to the

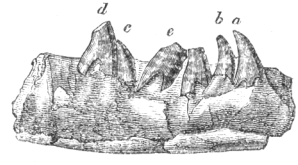
Figs. 1, 2, 3, & 4.—*Part of the left ramus of the lower jaw, with teeth, of* Nuthetes destructor, Owen.

Fig. 1.



Outside, nat. size.

Fig. 2.



Inside, nat. size.

Fig. 3.

End view, nat. size.

Fig. 4.

Magnified view of two of the teeth (*d*, *c*).

Monitors of the modern genus *Varanus*. The length of the fragment is $1\frac{1}{2}$ inch; the depth of the outer wall (fig. 1) is 6 lines, that

* Abbreviated from *νουθέτητης*, *monitor*, in reference to the affinities of the fossil to the modern lizards so called.

of the inner wall (fig. 2) is from 3 to 4 lines. The exterior surface of the bone is smooth and polished, but impressed by very fine, longitudinal linear markings, and perforated by nervous or vascular foramina along the alveolar wall: it is traversed near the lower margin by a line answering to the suture dividing the dentary from the angular piece in the jaw of the *Varanus*. The ramus is compressed (fig. 3), scarcely 2 lines across at its thickest part, but it has been slightly crushed.

The enamelled crowns of the teeth are moderately long, slender, compressed, pointed, slightly recurved, and with a well-marked serrated margin both before and behind (fig. 4, magnified): they are thickest towards the anterior part, as in the *Megalosaurus*, and closely resemble, in miniature, the teeth of that great carnivorous reptile.

The present fossil differs, however, from the *Megalosaurus* in having the inner alveolar ridge of the jaw not more developed than in the modern *Varani*, and in not exhibiting any rudiments of alveolar divisions; the bases of the teeth, which are anchylosed to the outer wall, being completely exposed on the inner side of the jaw (fig. 2.) In the two largest teeth, *d*, *e*, which are 2 lines in diameter at their base, that base is excavated on the inner side through absorption caused by pressure of the matrix of a successional tooth. A young tooth, *c*, straighter and more conical than the rest, which has thus displaced its predecessor, is rising up between the two old teeth above described. The first and second teeth, *a* & *b*, in this fragment are fully formed, are entire, and show well the normal characters of the crown. At the opposite end of the series was the crown of a young tooth which had not risen above the outer alveolar wall. The crowns of the teeth are of a dark grey colour, marked with transverse bands of lighter grey.

The entire of this interesting fragment gives evidence of a carnivorous or insectivorous Lizard of the size of the *Varanus crocodilinus*, or great Land Monitor of India*. The specific name relates to the formidable adaptation of its teeth for piercing, cutting, and lacerating its prey.

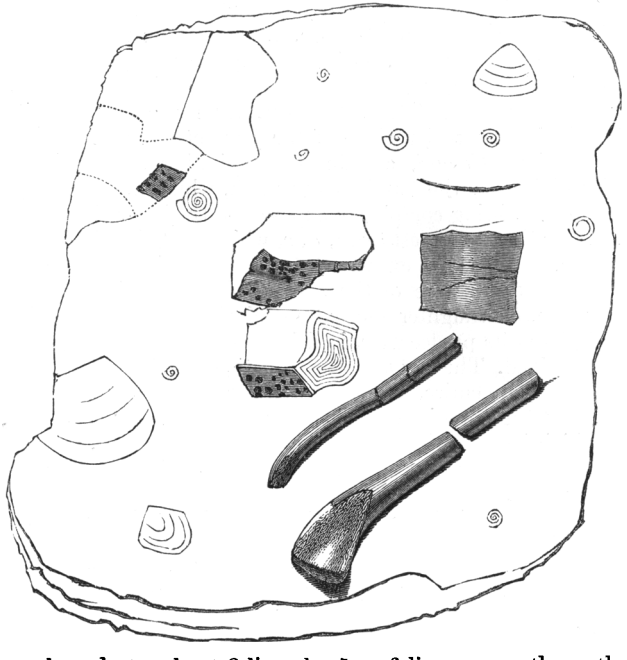
In a block of the laminated marly bed of the Purbecks, containing shells (*Cyclas* and *Planorbis*), transmitted by Mr. Willcox, are imbedded some fragments of bony scutes, and the major part of a tibia and fibula of a small Saurian reptile (fig. 5), agreeing in size with the species indicated by the above-described portion of jaw. The length of the portion of tibia preserved is $1\frac{1}{2}$ inch, and the impression of the shaft extends 3 lines longer: about the same length is indicated of the fibula by the bone and its impression. The diameter of the shaft of the tibia is $1\frac{1}{2}$ line; and the proportion of the length to the breadth of both bones is greater than in any known recent form of Lizard or Crocodile. The species to which the bones

* See my 'Odontography,' p. 265. pl. 68. fig. 3; fig. 3′ gives a magnified view of the crown of a tooth of this species, showing its resemblance to the fossil. The specimen above described was obtained at the Feather Quarry, and from the division of the Chert-beds marked J. 81–84. in the stratigraphical list in the Rev. Mr. Austen's 'Guide to the Geology of the Isle of Purbeck,' 8vo. Blandford, 1852.

of the leg in the present slab belonged must have been characterized by unusually long and slender hind-legs.

The scutes, as shown by their impressions on the matrix (fig. 5),

Fig. 5.—*Slab of stone from the "Feather Quarry," Purbeck, with* Cyclas *and* Planorbis, *and containing fragments and impressions of square reptilian scutes, and the tibia and fibula of a small reptile* (Nuthetes?). *A fish-scale also is seen in the middle of the slab, lying against one of the scutes.* Nat. size.



were subquadrate, about 8 lines by 5 or 6 lines; smooth on the inside; impressed by minute circular pits on the outside; and presenting more the character of the bony scutes of *Crocodilia*, than of those of any of the modern Lizards that possess dermal bones.

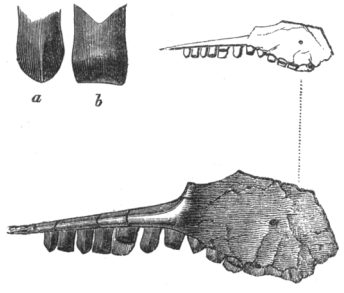
Macellodus Brodiei, Owen.

Of the specimens discovered by W. R. Brodie, Esq., in the fresh-water shelly "dirt-bed" of the Purbecks, at Durdlestone Bay, I propose first to describe those that are referable to the class *Reptilia*.

The characters of the Lacertian order in this class are unequivocally shown in the specimen, marked *f* 7, in Mr. Brodie's collection, and represented in fig. 6, of the natural size in outline and magnified in tint. It consists of a right superior maxillary bone, containing eight nearly entire teeth, and showing the places of attachment of thirteen or fourteen such teeth; which teeth are anchylosed to the bottom of an alveolar groove and to the side of an outer alveolar ridge. The

crown of these teeth is broad, laterally compressed, with an almost semicircular contour, and slightly pointed where unworn, as at *a*, fig. 6;

Fig. 6.—*Part of the right side of the upper jaw, with teeth, of the* Macellodus Brodiei, Owen. (Nat. size, and magnified.)



a, *b*. Two of the teeth magnified.

but some of them exhibit the summit either worn away or broken off, as at *b*: the enamel is marked by very fine longitudinal ridges, which give a subcrenate character to the unworn margins of the crown. The third tooth in the present specimen exhibits the minute germ of a successional tooth entering the cavity on the inner side of its base. The eighth tooth is represented by the apical half of the crown, which has not arisen to the level of the outer alveolar groove: the tooth which this germ was in course of succeeding has been shed or broken away. The third and sixth teeth are less advanced than the second, fourth, and fifth teeth.

The inner part of the alveolar groove, from the second to the seventh tooth inclusive, terminates internally in a free smooth convex surface, which has formed the outer boundary of a wide and extended palatal vacuity, as in modern Lizards. Beyond this the upper jaw expands to join the palatine bone. This structure, with the unequal development, and the evidence of the succession, of the teeth, together with their mode of implantation, gives unequivocal proof of the saurian nature of the fossil in question. From the resemblance of the teeth of this small Lizard to the blade of a spade, I propose to call the genus which it represents *Macellodus* (*μάκελλα, a spade, ὀδούς, a tooth*), and the species, in honour of its discoverer, *Brodiei*.

The specimen was obtained from a part of the Purbecks, marked K. 93. in Mr. Austen's 'Guide,' and called the "dirt-bed, containing shells*," high up the cliff, at Durdlestone Bay, Isle of Purbeck.

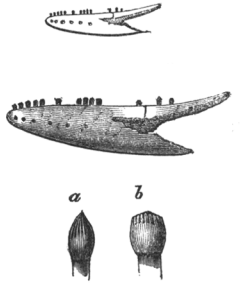
To the same species belong some at least of the organic remains in the specimen marked *K. 7.* in Mr. Brodie's collection.

This is a block from the Purbeck formation of a laminated marly character, from the lower part of the so-called "dirt-bed, containing

* The specimens of this deposit sent with the bones contain *Physa Bristovii*?, *Valvata*, *Limnæus*, *Cypris*, and vegetable remains.

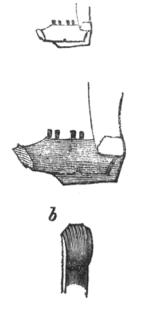
shells." In it are imbedded some dermal bony scutes, portions of ribs, the neural arch of a vertebra, and parts of the dentary elements of the rami of a lower jaw with teeth—one (fig. 7) containing thirteen teeth, the other (fig. 8) four teeth; in both figures the natural size is given in outline. The teeth are anchylosed to an exterior alveolar wall, and have short, broad, subcompressed, rounded, obtuse crowns (*b*, *b*). The hinder teeth show a little increase of size, are more obtuse and compressed, and are slightly expanded. Some of the anterior teeth (fig. 7, *a*) are a little pointed. The enamel is

Fig. 7.—*Part of the left side of the lower jaw, with teeth, of the* Macellodus Brodiei, Owen. (Nat. size, and magnified.)



a, *b*. Two of the teeth magnified.

Fig. 8.—*Part of the lower jaw, with teeth, of the* Macellodus Brodiei, Owen. (Nat. size, and magnified.)



b. One of the teeth magnified.

polished, but is marked by fine longitudinal grooves as it approaches the summit of the crown, like those in the upper jaw of the *Macellodus*; from which character, and from the progressive acquisition of a similar spade-like shape of the crown, as the teeth recede from the apex of the jaw, I conclude that the present is the lower jaw of the same species. The teeth are separated on the average by a space equal to the antero-posterior diameter of the crown; but some are closer together, others wider apart. The dentary bone (fig. 7) containing them exhibits a wide posterior notch for articulation with the angular and surangular elements. The outer surface of the dentary element is smooth and convex. The teeth are much smaller in proportion to the jaw than in the *Nuthetes*, figs. 1 & 2, and evidently belong to a distinct genus of Lizard.

The dermal scutes are subquadrate, smooth, and slightly concave on the inner surface; they are impressed with small round pits on the outer surface, as in the existing loricated reptiles; but the teeth in the portions of jaw in the same block are anchylosed to the jaw, not lodged in distinct sockets as in the *Crocodilia*. In a specimen of two of these scutes in natural juxtaposition, one slightly overlaps the other. The neural arch of the vertebra in the same block ex-

hibits long diapophyses, as in the lumbar and anterior caudal vertebræ of most modern Lizards, a moderately long spine, and a circular neural canal: the exposed surface of the arch is fractured, and the zygapophyses have been removed. There is no trace of the vertebral body, which has most probably been detached from the sutural connection with the arch, before this became imbedded in the present matrix.

In modern *Lacertilia* the neural arch anchyloses with the centrum at an early period, but in the *Crocodilia* it retains its sutural union. On the supposition of the neural arch being separated from a sutural union and not broken away, that arch would accord with the crocodilian characters afforded by the subquadrate scutes; the size of the two parts also supports their reference to the same animal. The presence in the same block of the Lacertian jaws and teeth leads to a suspicion that they belong to the same reptile; but similar crocodilian scutes are associated, in another block of Purbeck clay, with jaws and teeth of an animal to which they could not have belonged.

The length of the portion of the dentary bone containing the thirteen teeth is 17 millimetres, or 9 lines.

The breadth of the neural arch across the diapophyses, and including them, is 20 millimetres, or 10 lines; the long diameter of one of the scutes is 17 millimetres, or 9 lines; its breadth is 6 lines, or 13 millimetres.

Fig. 7 *a* is a magnified view of one of the anterior teeth, and fig. 7 *b* of one of the hinder teeth in the dentary bone, fig. 7.

As the anterior teeth in this specimen present nearly the same degree of resemblance to those figured in my 'Odontography*,' that have been referred to the *Hylæosaurus*, as the teeth of the *Nuthetes* do to those of the *Megalosaurus*, it became equally necessary to consider the question of the relationship of the *Macellodus* to the *Hylæosaurus*, as being possibly the young of the latter Wealden reptile.

The teeth of the *Macellodus* that most resemble those of the *Hylæosaurus* do not present so long and cylindrical a base, so angular an expansion of the crown, or the mode of abrasion of the crown by two sloping facets meeting at an angle of 80°, which is peculiar to the presumed Hylæosaurian teeth: moreover, the correspondingly enlarged representations of the spade-shaped teeth of the *Macellodus* have not yet been met with in the Wealden strata that have yielded the teeth and other remains of the *Hylæosaurus*.

The large Saurian teeth that come nearest in shape to the typical and most numerous teeth of the *Macellodus* are those of the *Cardiodon* of the Forest Marble of Wiltshire (Odontography, pl. 75 A. fig. 7 *a*), and of the *Palæosaurus platyodon* of the Magnesian conglomerate (*op. cit.* pl. 62 A. fig. 7): but the differences which will be seen on comparing the enlarged figures of the teeth of *Macellodus*, figs. 7 & 9, with the above-cited figures, are not reconcileable with the supposition that they might be due only to a difference of age of individuals of the same species.

* Vol. i. pl. 62 A. fig. 8 *a*, *b*.

GONIOPHOLIS CRASSIDENS, Owen; Brit. Assoc. Report, 1841, p. 69.

In some of the blocks of Purbeck stone transmitted by both Mr. Willcox and Mr. Brodie are imbedded portions of jaws, teeth, and other parts of the Swanage Crocodile (*Goniopholis crassidens*).

I shall not, however, dwell on the remains of this well-known reptile of the Purbecks, but proceed at once to the description of the most novel and interesting fossils of the present collection, which have been obtained exclusively by Mr. Brodie.

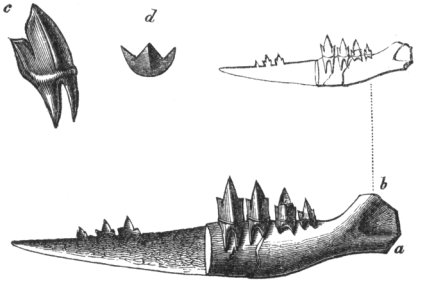
CLASS MAMMALIA.

At first sight the specimens appeared, as their discoverer had supposed, to differ only in species from the similarly-sized jaws of the Lizards with which they were associated; and it was only after a careful removal of the matrix that concealed their most characteristic features, that I became satisfied of their relationship to the Mammalian class.

SPALACOTHERIUM * TRICUSPIDENS, Owen.

The first of the specimens indicative of the little insectivorous mammal, for which the above name is proposed, is a left ramus of the lower jaw, indicated by nearly the whole of the posterior half, and by the impression of nearly the anterior half of the bone: it is represented, of the natural size in outline, and magnified in tint, at fig. 9. The posterior half contains four teeth, which at first sight

Fig. 9.—*Left ramus of the lower jaw, with teeth, of the* SPALACOTHERIUM TRICUSPIDENS, Owen. (Nat. size, and magnified.)



a, *b*. Proximal extremity of jaw.
c. Oblique view of a molar tooth.
d. Crown of the same, seen from above.

appeared to have simple long slender pointed conical crowns, with a basal ridge. The portion of jaw containing them extended backwards beyond the dental series; and, instead of showing the com-

* From σπάλαξ, *a mole*, & θηρίον, *a beast*.

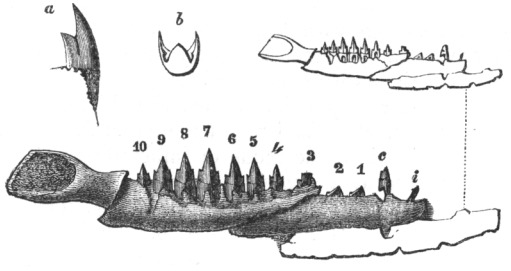
pound structure which that part of the jaw exhibits in the Lizard tribe, continued undivided, with the convex surface as it were bifurcating to include a smooth depression, the lower division or ridge, *a*, answering to that going to the condyle and angle of the jaw, and the upper one, *b*, to that going to the coronoid process, in the ramus of the jaw of the Mole and Shrew. This character first led me to endeavour to ascertain more of the characters of the fossil; but before meddling with this delicate and brittle but most precious evidence of the Purbeck fauna, I committed it to Mr. Dinkel's care, for a drawing of the part of the natural size, and a magnified view of so much as was exposed of the largest of the teeth. Having received these drawings with the specimen, I proceeded to expose more of the crowns of the teeth, when they were found to be tricuspid, the inner part of the crown being produced into a point both before and behind the longer cusp which formed the chief outer division of the crown, and which alone had been exposed on first view. I next proceeded to examine into the mode of implantation of these teeth, and found them fixed by a fang divided externally into two roots, in a distinct forked socket in the substance of the jaw. The multicuspid crown, the divided root of the tooth, its complex implantation, and the undivided or simple structure of the ramus of the jaw, all concurred, therefore, to prove the mammalian nature of this fossil.

Fig. 9 *c* is an oblique view of the anterior side of the crown of the first of the four teeth, showing that the basal ridge bends up and is lost upon the side of the accessory cusp. Both the posterior and anterior cusps project upwards on a plane more internal than the middle or chief cusp; and the crown of the tooth, viewed vertically, gives the contour represented in fig. 9 *d*. The four back teeth represented in fig. 9 progressively decrease in size to the hindmost, which seems to be the last of the series. The sharp multicuspid character of so much of the dental series as is here preserved repeats the general condition of the molar teeth of the small insectivorous Mammalia in a striking degree: one sees in them the same fitness for piercing and crushing the tough chitinous cases and elytra of insects. The particular modification of the pointed cusps, as to number, proportion, and relative position, resembles in some degree that of the Cape Mole (*Chrysochlora aurea*), but accords more closely with that of the extinct *Thylacotherium* of the Oolite (Trans. Geol. Soc. 2nd Ser. vol. vi. pl. 6. fig. 1) than with any of the existing types of insectivorous dentition.

The minor antero-posterior extent of the crown is considerable as compared with the proportion of that diameter with the height of the crown in the true molars of any of the modern Moles and Shrews, except the *Chrysochlora*. The impressions of the inner side of some teeth anterior to those in place show plainly the tricuspid character of the crown, and indicate also a greater number of such molars in the fossil than in any of the recent mammalia, with the exception of the marsupial *Myrmecobius*; of this further and more important affinity of the *Spalacotherium* to the *Thylacotherium*, the following specimens yield more decisive evidence.

d 7. The specimen so marked is a portion of the so-called 'dirt-bed,' from the Purbecks at Durdlestone Bay, having imbedded in it the right ramus of the lower jaw of the *Spalacotherium*, wanting the ascending branch, but containing one incisor, a canine or canine-shaped premolar, and ten succeeding molar teeth. It is represented of the natural size in outline, and magnified in tint, in fig. 10.

Fig. 10.—*Right ramus of the lower jaw, with teeth, of the* SPALACOTHERIUM TRICUSPIDENS, Owen. (Nat. size, and magnified.)



a. Oblique view of the molar tooth No. 8.
b. Crown of the same, seen from above.
c. Lanariform tooth (=first premolar ?).
i. Incisor.

The incisor, *i*, is the smallest of these teeth, and has a subquadrate or very obtusely-conical crown, convex externally. The canine or canine-shaped premolar, *c*, is more than twice as long and broad as the incisor, with a subcompressed, sharp-pointed conical crown, a little inclined backwards; it appears to have been inserted by a divided root, like the similarly-shaped and proportioned first premolar in the Mole. The two succeeding teeth, 1 & 2, are one-third smaller than the canine, with subcompressed, conical crowns, at the fore and back part of which the base is slightly produced: each is implanted by two distinct fangs. The third and fourth teeth have a similar form and complex implantation, but are somewhat larger, and the basal cusps are more developed: in the fourth tooth this development gives a distinctly tricuspid character to the crown, the middle cusp, representing the crown of the preceding teeth, being the largest and highest. The six following teeth, 5 to 10, repeat the same unequal tricuspid form, with increased but varying size; the middle teeth, 6, 7, 8, being the largest, and the last tooth, 10, diminishing in size in a greater ratio than the penultimate one, 9. These last six molar teeth are so close together that it was difficult at first to persuade oneself that they were not so united as to constitute fewer and more complex molars. The lateral cusps incline inwards and project from a plane more internal than the longer middle cusp. The inner side of the crown presents a wide longitudinal groove at the base of the middle cusp, between the inwardly inflected lateral cusps: the base of the crown presents externally a well-defined narrow

cingulum or ridge; beneath which the two fangs, or the two external fangs, descend into the substance of the jaw.

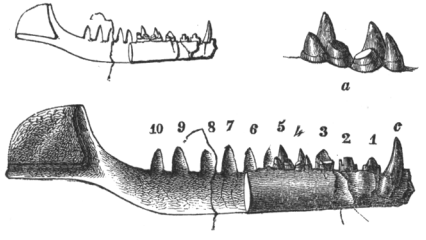
In the state in which this most instructive portion of the Spalacothere was presented to me, the matrix concealed all save the large middle cusp of the molar teeth, which teeth then seemed to be wider apart, and presented a more lacertine aspect. By the careful application of a fine needle and graving tool, I succeeded in displaying the lateral cusps and grinding surface of the crown, and the other teeth, as shown in the enlarged view given in fig. 10.

Fig. 10 *a* gives a magnified view of the antepenultimate molar, 8, viewed obliquely from behind; and fig. 10 *b* is an outline of the crown of the same tooth, viewed vertically: these figures accurately represent the mammalian and insectivorous characters of the teeth.

So much of the jaw-bone as is preserved in this specimen, fig. 10, corresponds in size and shape with the portion and impression of the opposite (left) ramus, fig. 9; and shows the same vertical contraction or decrease of diameter behind the molar series, prior to the expansion of the jaw into the ascending ramus. The horizontal ramus has suffered an oblique fracture since its fossilization across the alveolar series, with a very slight depression of the fore part containing the four anterior teeth: a second fracture crosses the contracted part of the jaw behind the last molar in place. There is not any clear evidence of a smaller molar tooth behind the last in place, marked 10. Between the large laniariform tooth, *c*, and the fore end of the ramus of the jaw, there is space for three incisors like the small one preserved, *i*, and also for a small canine, which tooth is demonstrated in one of the specimens (*a* 7) in Mr. Brodie's collection.

The specimen marked *e* 7 in this series is the anterior half and an impression of most of the remaining part of the left ramus of the lower jaw, with its inner surface exposed, showing the large canine

Fig. 11.—*Inner aspect of a left ramus of the lower jaw, with teeth, of the* SPALACOTHERIUM TRICUSPIDENS, Owen. (Nat. size, and magnified.)



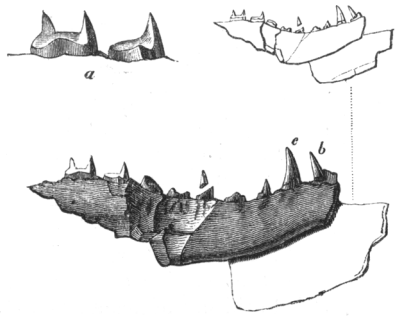
a. Two molars, numbered 4 & 5. *c*. Premolar or canine ? tooth.

or canine-shaped premolar, *c*, and five following teeth in place, a fragment of a sixth molar, and impressions of four succeeding molars. The crown of the canine-shaped tooth is long, subcompressed, slightly recurved, pointed, with a posterior basal tubercle. The adjoining

tooth has a compressed, pointed crown, scarcely half the height of the canine and two-thirds as broad at the base, with a ridge along the inner side of the base, and a more developed posterior basal tubercle: it is divided by a small interval from the canine. The second molar, with a slight increase in size and a similar shape, has the fore part of the basal ridge developed into a low point, and the hinder tubercle is relatively larger and more pointed. The third tooth is larger than either of the two preceding, but resembles them in form. The fourth, with the same antero-posterior extent, has a lower crown, the middle cusp being relatively shorter, but both the anterior and posterior ones are larger, and now begin to assume the character of independent cusps; their bases almost meeting upon the inner side of the base of the middle cusp. The fifth molar, with a slight increase of size, shows a still further development of the accessory cusps, which now are inclined backwards, or project from a more internal plane than the middle cusp. The impressions of the succeeding teeth show that their middle cusp was longer in proportion to its basal breadth; and thus agree, like the foregoing teeth, with the teeth similarly marked in fig. 10. The canine-like tooth seems to have a bifid fang; the three succeeding premolars, implanted each by two fangs, in this respect, as in their general form and proportions, resemble the four premolars of the lower jaw of the Mole. The ramus of the jaw very closely resembles in shape that of the Mole, but is larger than that of the *Talpa europæa*, being 1 inch 3 lines, or 32 millimetres in length, that of the Mole being 1 inch, or 25 millimetres. The crown of the laniariform tooth is relatively longer, and the fourth tooth counting therefrom is of a different form, being of much smaller size and of a more simple structure than is the corresponding tooth which forms the first true molar of the Mole. The greater number of molar teeth indicated in the present and displayed in other specimens of the *Spalacotherium* decisively demonstrate not only its specific but generic distinction from the Mole, or any known existing insectivore; the marsupial Myrmecobius being the sole mammal, with incisors and canines, that resembles the Spalacothere in the excessive number of the molar teeth. Fig. 11 *a* is a magnified view of the teeth 4 & 5, showing the meeting of the accessory cusps on the inner side of the crown.

In the specimen marked *a* 7 in Mr. Brodie's series, and represented in fig. 12, the tooth, *b*, that immediately precedes the large canine-shaped tooth, *c*, is preserved; it is also canine-shaped, but about half the size of that tooth. There is a trace of a small incisor in the crushed and broken anterior end of the jaw in front of the above teeth. This specimen the more inclines me to the belief that the larger canine-shaped tooth is the first premolar, as in the Mole; but it appears to be implanted by a simple expanded base in the present specimen: the crowns of the three succeeding teeth, and the fractured bases of the crowns of the four or five following molar teeth are shown in this mutilated portion of the right ramus of the lower jaw of the *Spalacotherium*. Fig. 12 *a* is a magnified view of two of these teeth, from which the middle and hind cusps have been broken away.

Fig. 12.—*Portion of the right ramus of the lower jaw, with teeth, of the* SPALACOTHERIUM TRICUSPIDENS, Owen. (Nat. size, and magnified.)



a. Two molars, without the middle and hind cusps; magnified.
b. Canine tooth?
c. First premolar?

In the same block of Purbeck "dirt-bed" are imbedded part of a vertebra, a fragment of the jaw with a few teeth of the *Macellodus*, and three of the small subquadrate and externally pitted dermal scutes. There is also a beautifully clear impression of the dentary bone, with six or seven of the anterior minute teeth, and a row of fine vascular pits or foramina, of the *Macellodus*.

In regard to the *Spalacotherium*, sufficient evidence, it seems to me, is afforded by Mr. Brodie's fossils, described in the foregoing pages, to satisfy the most scrupulous palæontologist as to the mammalian and insectivorous character of the species. The portions of the jaws and teeth on which the genus and species are founded, show precisely the same dark charred colour as the reptilian fossils with which they are associated; and there can be no doubt of the mammalian and lacertian remains being of the same date, included, as they often are, in the same block of matrix. There is no satisfactory evidence of the marsupial character of the jaws of the *Spalacotherium*: from the great number of the tricuspidate molars, one might be inclined to infer its affinity with the recent Myrmecobius; but, although the molar teeth are not so numerous in any placental Insectivore, they manifest so much variety in number and shape, in the existing species, that a further deviation from the common type in regard to number would not be a very violent departure from the characters of the true Insectivorous order. The straight uninflected angle of the lower jaw of the *Thylacotherium* has led me to view that genus as more nearly allied to the placental than to the marsupial Insectivora; and the *Spalacotherium* has closer affinities with the *Thylacotherium* than with any known existing *Insectivora*. In a comparison with these, the Spalacothere most closely resembles, as to the shape of its teeth, the iridescent Cape Mole (*Chrysochlora aurea*):

the last five molars of this species have tricuspid crowns, with the anterior and posterior smaller cusps on a plane more internal than the middle one, but the smaller cusps are given off nearer the summit of the crown. These teeth also resemble the molars of the Spalacothere in their small antero-posterior extent, but they are fewer in number and are placed farther apart in the Cape Mole, which also is restricted to the number of ten teeth in each ramus of the lower jaw, incisors and canine inclusive.

The Spalacothere has nearer affinities, as has been already intimated, to the Thylacothere of the Stonesfield Oolite than to any known existing species of Insectivore, and from the present evidence I should place it in the same natural family of the Insectivorous order of Mammalia.

Touching the wider question of the successive appearance of the grades of animal life on this planet, the present acquisition from the Purbecks in no way affects the question as it was left by the long-contested but finally settled evidence of mammalian life at the period of the deposition of the oolitic slate at Stonesfield.

Between that period and the oldest of the tertiary deposits, where hitherto mammalian remains have next presented themselves in the order of appearance, the interval is immense; the lapse of time having sufficed to allow of the deposition of the oolitic strata from the Great Oolite upwards, of the Wealden and Neocomian beds, and of the formation, by more or less minute marine animals, of the major part, if not the whole, of the carbonate of lime of which our Chalk downs and cliffs consist. The chief interest in the discovery of the *Spalacotherium* is derived from its demonstration of the existence of Mammalia about midway between the older oolitic and the oldest tertiary periods.

Both the Oxford oolitic slate and the Purbeck marly shell-beds give evidence of insect-life; in the latter formation abundantly, as was shown in Mr. Westwood's paper read at a former meeting of the Society*. The association of these delicate Invertebrates with remains of plants allied to *Zamia* and *Cycas* is indicative of the same close interdependency between the insect-class and the vegetable kingdom, of which our power of surveying the phænomena of life on the present surface of the earth enables us to recognize so many beautiful examples. Amongst the numerous enemies of the insect-class ordained to maintain its due numerical relations, and organized to pursue and secure its countless and diversified members in the air, in the waters, on the earth and beneath its surface, bats, lizards, shrews, and moles now carry on their petty warfare simultaneously, and in warmer latitudes work together, or in the same localities, in their allotted task. No surprise need therefore be felt at the discovery that mammals and lizards co-operated simultaneously and in the same locality at the same task of restraining the undue increase of insect life during the period of the deposition of the Lower Purbeck beds.

The placental Insectivora are far from being the highest of the Mammalian class, but at the same time they are not the lowest: if

* See above, p. 378.

they have small unconvoluted brains, they are unguiculate and claviculate; some are fitted for flight (*Vespertilionidæ*), some for swiftly burrowing in the earth (*Talpidæ*), some for swimming and diving (*Soricidæ*), others for rapid course over the dry land (*Macroscelidæ*).

All that can be legitimately inferred as to the grade of mammalian structure now brought to light from the oldest of the Wealden epochs is that it displays the mammalian modification which we know to be best adapted to profit by a co-existence with the insect population of the same period.

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2. *On a* SECTION *lately exposed in some Excavations at the* WEST INDIA DOCKS. By W. T. BLANFORD, Esq.

[Communicated by the President.]

AN excavation lately made to join two portions of the West India Docks has exposed a section of the deposits in the valley of the Thames to a depth of above 30 feet, showing beds of peat with stems of trees, and, below these, gravels containing organic remains. The thickness of the different beds varies considerably, but their general succession and their measurement where best exposed are shown by the accompanying diagram, p. 434.

The two beds, *c* & *d*, vary in character and thickness; stems of trees, most of which lie horizontally, though some of the smaller ones are vertical, are scattered throughout the peat; and this deposit is interspersed with specks of blue phosphate of iron. Throughout the clay, *c*, are sparingly scattered the following species of freshwater shells:—

Bithinia tentaculata.	Limnæus pereger.
Limnæus palustris.	Ancylus fluviatilis.

At the bottom of the bed of peat at one place a considerable number of land and freshwater shells of the following species occur (the bivalves having both valves together):—

Helix nemoralis.	Bithinia tentaculata.
H. rotundata.	Ancylus fluviatilis.
Clausilia laminata.	Pisidium amnicum.
Succinea putris.	Unio.
Valvata piscinalis.	

This bed, *d*, rests on the very uneven surface of the underlying clays, sands, and gravels (*e*, *f*, *g*), which are much false-bedded, and in some places evidently deposited by currents of considerable strength; beds of sand and small rolled pebbles, dipping at a considerable angle, lie between other beds which are horizontal, though thinning out at short distances. Towards the bottom these are exclusively of pebbles, much larger than those in the upper part, and mainly composed of chalk-flints, some of which are very much rolled, others very little; many broken, and with the edges but little rolled. Pebbles of different kinds of sandstone and of vein-quartz also occur.