

tending to post-alar calli, admedian stripes extending from front margin to about one-third of distance from transverse suture to præsutural furrow, median stripe, when present, usually pointed anteriorly and not extending to front margin, but behind broad and reaching præsutural furrow; below outer dorsal stripe on each side, especially in ♂, there is often an additional dark longitudinal stripe; in ♂ specimens in certain lights a broad dark stripe can be seen running from hind margin of humeral callus, across upper portion of mesopleura, to mesopleural suture. *Abdomen*: venter grey, median scutes darker.

India, Ceylon, Sokotra, Cyprus, Senegal, and Congo Free State: types of ♂ and ♀ and four other specimens from India (*Bombay Natural History Society*); 2 ♀ ♀ from Calcutta, India, 23. vii. 1907, "on draught bullocks, burrowing into the hair" (*received from the Indian Museum, Calcutta*); 1 ♂, 1 ♀, from Mussoorie, United Provinces, India, Sept. 1906, and 1 ♀ from Allahabad, United Provinces, India, 11. x. 1905 (*F. M. Howlett*); 2 ♂ ♂, 5 ♀ ♀, from Bentota, Ceylon, 13. vi. 1891 (*Lt.-Col. Yerbury*); 1 ♂ from Dankotuwa, Ceylon, 1899 (*C. G. Rodrigo*); 2 ♂ ♂ from Hadibu Plain and Dahamis, Sokotra, 12 & 19. xii. 1898 (*W. R. O. Grant*); 3 ♂ ♂, 12 ♀ ♀, from Larnaca, Cyprus, 4. viii. 1908 (*Dr. G. A. Williamson*); 3 ♂ ♂, 1 ♀, from St. Louis, Senegal, W. Africa, 16. v. 1903, "feeding on donkeys on race-course" (*the late Dr. H. E. Dutton and Dr. J. L. Todd*); 1 ♂, 1 ♀ from the Congo Free State, 1903 (*Drs. Dutton, Todd, and Christy*). Writing from Larnaca, Cyprus, on October 23, 1908, with reference to this species, Dr. G. A. Williamson remarked:—"That this is a biting fly my ankles have on many occasions borne evidence, and I notice that horses can stand its bite very little, becoming much more restive than with the *Hippobosca* [*H. equina*, Linn.], which seems to cause them little inconvenience."

XXXVIII.—*On some new Steneosaurs from the Oxford Clay of Peterborough.* By C. W. ANDREWS, D.Sc., F.R.S. (British Museum, Natural History).

[Plates VIII. & IX.]

THE splendid collection of reptilian remains obtained by Mr. A. N. Leeds, F.G.S., from the Oxford Clay in the neighbourhood of Peterborough, includes the skeletons of

many marine crocodiles. The commonest of these are species of *Metriorhynchus*, but *Steneosaurus* and *Dacosaurus* are also represented. In the present paper it is proposed to give a brief account of the species of *Steneosaurus* included in the collection. One of these, *Steneosaurus edwardsi*, has already been described in detail by E. Deslongchamps * from specimens from the Oxford Clay of Vaches Noires, Normandy. In addition to this, which need not be further noticed, there appear to be at least four other species, none of which seem to agree at all closely with previously described forms and they will therefore receive new names.

STENEOSAURUS.

This genus is here regarded as it was emended by Deslongchamps and afterwards adopted by Lydekker and others. Lydekker's definition given in the 'Catalogue of Fossil Reptiles in the British Museum,' pt. i. (1888), p. 168, is here followed, all the species described falling within it, with the possible exception of that named *S. obtusidens*, which may eventually have to be referred to a new genus.

Steneosaurus leedsi, sp. n. (Pl. VIII. fig. 1.)

Professor Bigot † has recently described a *Steneosaur* with a very long and slender snout from the Callovian of Calvados, and for it he has adopted the name *Steneosaurus roissyi*, a species originally established by E. Deslongchamps ‡ on the evidence of some small fragments of a mandible from the Oxford Clay of Vaches Noires. Mr. Leeds has pointed out to me that there can be little doubt that the type specimens are portions of the jaw of a *Metriorhynchus*, so that the name is not that of *Steneosaur* at all. In the Leeds collection is a very fine skull and mandible (R. 3320), the latter closely resembling the one figured by Bigot; and these specimens I propose to make the types of a species *S. leedsi*, to which Bigot's specimen no doubt is likewise referable.

The chief peculiarities of this species are the great length and slenderness of the flattened snout. Thus the length of the skull (from the occipital condyle to the tip of the nose, allowing for 1 or 2 centimetres broken away) is 81 cm., while that of the pre-orbital region is 59.5 cm., or about $73\frac{1}{2}$

* Notes Paléontologiques, vol. i. (1863-69) p. 239, pl. xvii. figs. 1-3.

† "Notes sur les Reptiles Jurassiques de Normandie," Bull. Soc. géol. de Normandie, vol. xvii. (1896) p. 23, pl. ii. fig. 1.

‡ Notes Paléontologiques, vol. i. p. 252, pl. xvi. figs. 3, 4.

per cent. of the whole length. In the case of the mandible the total length is 89 cm.; that of the symphysial region is 52 cm., or about 58 per cent. In the mandible figured by Bigot the total length is 100 cm., the length of the symphysis is 55 cm. Both the proportions of the length of preorbital portion of the rostrum to the whole length of the skull and of the symphysis to the whole mandible are greater than in other species. In *S. megistorhynchus*, which seems to be the next most elongated form, the symphysial portion of the mandible is only 50 per cent. of the whole. Another characteristic of *S. leedsi* is the large number of teeth present, there being 45-46 on each side of the upper jaw and 43-44 in the lower.

In the skull the temporal fossæ are very large and are much longer than broad (length 12 cm., breadth 7.3 cm.). The orbits are rather large and are oval in outline; they look upwards and outwards, as in other members of the genus. The combined frontals terminate anteriorly in an acute angle, considerably in front of the anterior border of the orbit; their upper surface is ornamented by a few scattered pits only. The nasals extend back to about the anterior third of the orbit, but their limit in front cannot be determined with certainty. The anterior part of the snout was greatly flattened from above downward: the end, formed by the premaxillæ, is somewhat expanded. The facial processes of the premaxillæ are short and terminate in a blunt point opposite the interval between the second and third maxillary teeth. On the palate the maxillo-premaxillary suture is nearly straight and is at right angles to the long axis of the skull. The palatal surface is flat in the premaxillary region, but behind this it is concave from side to side, the alveolar border forming a somewhat sharply raised rim: the convex upper surface of the symphysial region of the mandible fits closely into the concavity of the palate. The upper teeth are 45-46 in number. The two posterior premaxillary teeth are enlarged and are separated by an interval nearly equal to the diameter of their alveoli. The maxillary teeth are nearly equal in size throughout the series; they are directed downwards and forwards. The individual teeth are slender and sharp; they are slightly compressed at the extreme tip and the enamel is marked by a series of fine longitudinal ridges. The symphysial portion of the mandible is slightly expanded anteriorly, especially between the enlarged third and fourth teeth; its upper surface in this region is nearly flat, but behind it

becomes convex from side to side, rising considerably above the alveolar borders. The ventral surface is gently convex from side to side. The splenials extend forward in the symphysis to the 24th tooth.

The dimensions of the type skull and mandibles (R. 3320) of *Steneosaurus leedsi* are:—

<i>Skull.</i>		cm.
Total length	.....	81
Length in front of orbit	.....	59
Width between outer angles of the quadrates	....	18
Length of temporal fossæ (inner side)	.....	12
Width	.....	7·3
" of frontals between orbits	.....	3·9
" opposite anterior border of orbit	.....	10·5
" of middle of snout	.....	4·3
" behind premaxillary expansion	.....	2·9
" of premaxillary expansion	.....	3·8
<i>Mandible.</i>		
Total length	.....	89
Length of symphyseal portion	.....	52
Width at hinder end of symphysis	.....	7·3
" at narrowest point behind anterior expansion	.....	2·2

Steneosaurus nasutus, sp. n. (Pl. IX. fig. 1.)

The type specimen upon which this species is founded is a nearly complete but somewhat crushed skull and mandible. In some respects the skull shows an approximation to the *Teleosaurus* type, particularly in the relative shortness of the temporal fossæ in proportion to their width, and the position of the orbits, which appear to have looked more directly forward than in the other species of the genus. The frontals between the orbits are much sculptured with a number of pits and strong rugosities; the form of their anterior end cannot be determined. The upper surface of the triangular area of the parietals at the hinder end of the sagittal crest bears sculpture like the frontals. The rostrum is very long; in front of the orbit the narrowing of the skull is rapid for a short distance, then the sides of the slender rostrum become nearly parallel, as it narrows very slightly till just behind the premaxillary expansion, which seems to have been of considerable width. The two posterior teeth in the premaxilla are enlarged and closely set together. The maxillary teeth are nearly equal in size throughout the series: they seem to have been directed forwards and downwards; their crowns are comparatively

slender, sharp-pointed, and the enamel is marked by a series of very fine longitudinal ridges with a rather stronger and more continuous ridge on the outer side.

The mandible is slender and compressed vertically. The palatal surface appears to have been somewhat convex. The ventral surface is marked by an ornamentation of irregular longitudinal ridges. There is a slight anterior expansion and the third and fourth teeth are enlarged; there are 42 teeth on either side and their structure is similar to that of the upper teeth. The splenial extends into the symphysis as far as the twenty-second tooth. The posterior (ventral) limit of the symphysis is opposite the thirty-seventh tooth.

This species approaches *S. leedsi* in the length of its snout, the preorbital portion of which is about 73 per cent. of the whole length of the skull in both species; in the next species, *S. durobrivensis*, it is only about 61 per cent. In the number of teeth it also resembles *S. leedsi* and differs from *S. durobrivensis*, in which the number is smaller. On the other hand, it is sharply distinguished from *S. leedsi* by the shorter temporal fossæ, the position of the orbits and the strong sculpturing of the frontal bones; and the first two of these characters at least separate it from *S. intermedius*, *S. edwardsi*, and *S. heberti*, from all of which it differs further in the possession of a greater number of teeth.

The dimensions of the type skull and mandible of *Steneosaurus nasutus* are:—

<i>Skull.</i>		cm.
Total length		100
Length in front of orbits		73
Width between outer angles of the quadrates		25
Length of temporal fossæ (inner side)		14
Width		10.5
" of frontals between the orbits		6
" at anterior border of orbit		16.5
" of middle of snout		6.3
" behind premaxillary expansion		4.2
" of premaxillary expansion		7.3
<i>Mandible.</i>		
Total length		110
Length of symphysial portion		62
Width at hinder end of symphysis		11.6
" immediately behind anterior expansion ..		4.2

Owing to the crushing that the specimens have undergone, many of the above measurements can be regarded as approximate only.

Steneosaurus durobrivensis, sp. n. (Pl. VIII. fig. 2.)

A third species of *Steneosaurus* which occurs in the Leeds Collection has a considerably shorter rostrum than those just described, but at the same time it is longer than in *S. edwardsi*, which is found in the same beds. It differs from the contemporary *S. heberti* in possessing only 33 teeth in the upper jaw instead of 39–40 as in that species, and the mandibular symphysis is relatively longer. The points of difference from *S. intermedius* are the same.

The type specimen (Leeds Coll. 18) upon which it is proposed to found this species is a beautifully preserved and nearly complete skeleton, including:—skull, mandible; 9 cervical, 14 dorsal, 2 sacral, and 39 caudal vertebræ; many ribs of both cervical and dorsal regions, several chevrons; shoulder-girdle, humeri, (?) radius and ulna; pelvic girdle and most of the bones of the hind limb; many scutes from all regions of the body. In the present paper only the skull and mandible will be briefly described, the complete account being left for the 'Descriptive Catalogue of the Marine Reptiles of the Oxford Clay' now in preparation.

In the skull the temporal fossæ are very large and about twice as long as wide. They are separated by a high and very thin sagittal crest. The orbits are relatively rather smaller than in *S. leedsi* and are more widely separated. The frontals are almost smooth; their anterior angle is a little in front of the orbit; the form of their anterior border will be best understood from the figure (Pl. VIII. fig. 2), and differs widely from that of the frontals in *S. leedsi* and *S. heberti*, but approaches that figured by Bigot in *S. intermedius*. The nasals terminate anteriorly opposite the 16th maxillary tooth, counting from before backwards. In front of the orbit the rostrum narrows rather quickly at first, then very gradually to the premaxillary region, which is only a little expanded. The suture between the premaxilla and maxilla is convex posteriorly on the upper surface, the facial processes of the premaxilla extending back to the level of the second maxillary tooth. On the palate the suture between the two bones runs forward after crossing the alveolar border, and an anterior prolongation of the maxillæ is thus interposed between the small palatal plates of the premaxillæ. The median suture between these latter is interrupted by a foramen situated at the level of the socket of the third tooth.

The upper teeth are about thirty-four in number. The premaxillæ bear four each, of which the first two are small, crowded together, and directed forward; the third and fourth are large and their alveoli separated by four or five millimetres only. Behind these there is a short, concave, edentulous space; then follows the series of 29–30 maxillary teeth, which are relatively large, and are separated by intervals less than the diameter of their alveoli. The teeth are directed downward and a little forward.

The rami of the mandible are stout; they pass into the symphysial region by a gentle curve. The symphysis reaches back to the 25th tooth and the splenials extend forward in it to the level of the 17th tooth. Both the upper and ventral surfaces of the symphysis are nearly flat; there is a slight expansion between the enlarged third and fourth teeth; at the anterior end the line of junction of the two rami is marked by a deep median notch.

The first two lower teeth were small and directed nearly straight forward; the third and fourth are the largest in the jaw and are closely crowded together. Behind these there is a short diastema; then comes a series of about 27 teeth, a few of those in the front and close to the back being somewhat smaller than the others. They appear to have been directed upward and a little forward.

No good specimen of the teeth, either upper or lower, has been seen, all having either fallen from their sockets or been broken off short. Judging from some of the replacing germs, the crown would appear to have been blunter than those of the species described above, but much less so than is the case in the next species.

The dimensions of the skull and mandible in the type specimen of *Steneosaurus durobrivensis* are:—

Skull.	cm.
Total length	74
Length in front of orbit	45
Width between outer angles of quadrate	24*
Length of temporal fossæ (inner side)	18
Width " " "	8·8
" of frontals between orbits	5·4
" of middle of snout	6·4
" behind premaxillary expansion	4·8
" of premaxillary expansion	5·7

* Wider than in life, owing to the crushing outwards of the quadrate.

Mandible.

Total length	85
Length of symphyseal region	37.5
Width at hinder end of symphysis	10.2
„ at narrowest point behind anterior expansion.	3.8

Steneosaurus obtusidens, sp. n. (Pl. IX. fig. 2.)

One of the most important of the skeletons collected by Mr. Leeds is that of a very large and massively built crocodile, of which we possess the skull, mandible, numerous vertebrae and ribs, some bones of both the pectoral and pelvic girdles and of the fore and hind limbs, together with some scutes. These specimens (R. 3168) are the types of the present species.

The skull differs from that of the other *Steneosaurs* in having a thicker and more massive rostrum and teeth with thick blunt-pointed crowns. As in the last species, the temporal fossae are very large and about twice as long as broad. The orbits are large and oval. The frontals seem to have terminated anteriorly in a blunt point about on a level with the front border of the orbit; their surface is ornamented by a number of obscure ridges radiating from the centre of the united bones. The arrangement of the nasals and lacrymals cannot be made out, owing to the crushing that that region has undergone. There was a small slit-like antorbital foramen, about 7 cm. in front of the orbit. In front of the orbits the rostrum narrows very gently to a point about 16 cm. behind its anterior end, where it is only 6.2 cm. wide; the premaxillary region is expanded and the facial processes of the premaxillae terminate posteriorly in a blunt point. The nasal opening is transversely oval, the anterior border being interrupted by a prominence occurring at the point of union of the two bones. The rostrum, as a whole, is stout and its upper surface is strongly arched from side to side; the anterior end seems to have been bent a little upwards. The total number of teeth in the upper jaw cannot be made out, but it can be seen that in the premaxilla there were four, of which the two anterior are small and crowded together, so that the second is almost behind the first. The third and fourth are much enlarged.

In this skull the length of the preorbital region is about 61 per cent. of the whole; in *S. leedsi* and *S. nasutus* the proportion is about 73 per cent.; but in *S. durobrivensis* it is much the same as in the present species, which, however, differs in the more gradual narrowing of the rostrum.

The mandible is very massively constructed. The symphysial region, which occupies about 42 per cent. of the total length, is flattened ventrally and has a considerable anterior expansion, which is greatest at the sockets of the third and fourth teeth.

The lower teeth are about 28 in number. The first two are small, then follow two large teeth closely crowded together. Behind these is a rather small tooth, and behind this point the rest increase in size till near the hinder end of the series. The most remarkable character of this dentition is that about half the mandibular teeth bite into deep pit-like sockets in the maxilla; the outer walls of these pits form slight prominences on the alveolar edges of the maxillæ. If this peculiarity of the dentition is normal it would probably justify the establishment of a new genus for the reception of this species, but there is some doubt whether it may not be the result of great pressure, which has driven the points of the lower teeth into the maxilla, while the bone was in the clay in a semi-plastic condition.

The individual teeth are thick, circular in section, and have blunt points; the enamel of the crown is raised into a number of fine longitudinal ridges of varying length; in some of the teeth two or three ridges on opposite sides are more strongly marked than the others and are continuous from base to tip of the crown.

This crocodile seems to have been a very powerfully built animal, with jaws and teeth of greater strength than in the other *Steneosaurs*. The hind limb was very long, the femur alone measuring 45 cm. in length. A detailed account of the skull and skeleton will be given in the Catalogue above referred to.

The approximate measurements of the type skull and mandible (R. 3168) of *Steneosaurus obtusidens* are:—

<i>Skull.</i>		cm.
Total length		116
Preorbital length		71
Width between outer angles of quadrates		37.5
Length of temporal fossæ (inner side)		33
Width	(?)	14
" of frontals between orbits		8.5
" of middle of snout		9
" at narrowest point behind premaxillary expansion		7.3
" of premaxillary expansion		9.5

Mandible.

Total length	137
Length of symphysial region	58
Width at hinder end of symphysis	14
„ at narrowest point behind anterior expansion	6.2

EXPLANATION OF THE PLATES.

PLATE VIII.

- Fig. 1.* *Steneosaurus leedsi*, sp. n. Semi-diagrammatic figure of the upper surface of the type skull (R. 3320). $\frac{1}{5}$ nat. size.
Fig. 2. *Steneosaurus durobrivensis*, sp. n. Semi-diagrammatic figure of the upper surface of the type skull (Leeds Coll. 18). $\frac{1}{5}$ nat. size.

PLATE IX.

- Fig. 1.* *Steneosaurus nasutus*, sp. n. Upper surface of type skull (R. 3577). $\frac{1}{4}$ nat. size.
Fig. 2. *Steneosaurus obtusidens*, sp. n. Semi-diagrammatic figure of the upper surface of the type skull (R. 3168). $\frac{1}{7}$ nat. size.

XXXIX.—*The Genus Encrinus.* By AUSTIN HOBART
 CLARK, of the United States Bureau of Fisheries.

MR. F. A. BATHER in 1898 ('Natural Science,' xii. p. 245) attempted to unravel the snarl in which the generic names of the recent (and fossil) Pentacrinitidæ have become enmeshed, thanks to the nomenclatorial carelessness of certain of the writers on the subject of the Crinoidea. Passing over the fact that *Balanocrinus* is not available for any genus of Pentacrinitidæ, that *Metacrinus* was first diagnosed in 1882 (Bull. Mus. Comp. Zool. x. p. 167), and that *Isocrinus* was first proposed in 1836 (L. Agassiz, Mém. de Soc. de Sci. Nat. de Neuchâtel, i. p. 195, type *Isocrinites pendulus*, de (sic) Meyer, 1835, nomen nudum, = *Isocrinus pendulus*, von Meyer, 1837), we come to a consideration of the genus *Encrinus*. Mr. Bather ascribes *Encrinus* to Schulze, 1760; but Schulze was *not* binomial, as a glance at his work suffices to show; moreover, if he were, why does not Mr. Bather use his genera *Decacnimos*, *Polyactinis*, and *Triscædecacnimos* instead of the later *Antedon* and *Actinometra*?



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