

“barbed-arrow” appearance. Posteriorly, the denticles are almost destroyed in the figured specimen, but another fossil shows that they are largest in the middle, decreasing towards either end, and the points are all inclined downwards.

The only *pectoral spines* that can be associated with this species are, unfortunately, too imperfect for description. They seem to have been considerably arched, and have an ornamentation similar to that of the dorsals.

Formation and Locality.—Upper Eocene: Barton Cliff and High Cliff, Hampshire.

Such, unfortunately, is the most complete evidence of early Tertiary Siluroids that appears to have been hitherto discovered in the European area. Among Continental works, I have only succeeded in meeting with the single description of a dorsal fin-ray (“second”) and a fragment of a pectoral spine, from the Eocene (?) Beds of Austria,¹ in addition to a brief notice of the presence of the family in the Belgian Eocenes.² And from rocks of still earlier date, only one fish seems to have yet been referred to the same systematic position—the *Telepholis acrocephalus* of von der Marck, from the Upper Cretaceous of Westphalia;³ and this determination, it must be admitted, is scarcely placed beyond all doubt.

IV.—NOTE ON THE HORDWELL AND OTHER CROCODILIANS.

By R. LYDEKKER, B.A., F.G.S.

THE two admirable summaries of our knowledge of fossil Crocodilia recently published by Mr. A. Smith Woodward—the one relating to British forms, in this MAGAZINE,⁴ and the other, comprising the whole order, in the “Proceedings of the Geologists’ Association”⁵—render it a comparatively easy matter to find out what is known concerning any particular species or genus; and I may accordingly at once proceed to the proper subject of this paper.

Hordwell Crocodiles.—In the above memoirs Mr. Woodward⁶ follows the original suggestion of Sir R. Owen—more fully confirmed by Prof. Huxley—that the Crocodilian remains from the Upper Eocene (Lower Oligocene) of Hordwell described under the names of *Alligator Hantoniensis* and *Crocodylus Hastingsiæ* belong to one and the same species. The author adopts for this species the trivial name *Hastingsiæ* (although *Hantoniensis* has the priority), and retains it in the genus *Crocodylus*; remarking, however, that it presents characters which under certain circumstances might entitle it to rank as generically distinct. Sir R. Owen, in his original description of the so-called *C. Hastingsiæ*, remarked that the skull

¹ *Pimelodus Sadleri*, J. J. Heckel, “Beiträge zur Kenntniss der fossilen Fische Oesterreicher,” i. (1849), p. 15, pl. ii. fig. 3.

² H. Le Hon, “Préliminaires d’un Mémoire sur les Poissons Tertiaires de Belgique,” 1871, p. 15.

³ W. von der Marck, “Neue Fische und Krebse aus der Kreide von Westphalen,” Palæontogr., vol. xv. p. 276, pl. xliii. figs. 6, 7; also *ib.* vol. xxxi. p. 248.

⁴ *Supra*, Vol. II. pp. 496—510 (1885).

⁵ Vol. ix. No. 5 (1886).

⁶ GEOL. MAG. *op. cit.* p. 509.

presented many Alligatoroid features (which are of course enhanced by the inclusion of *A. Hantoniensis* in the same species), and that it was difficult to say whether the species should really be included among the Crocodiles or the Alligators. Prof. Huxley's observations, which proved the existence of a ventral dermal armour, showed that the Hordwell Crocodilian in this respect differed decidedly from all known members of the genus *Crocodilus*; but since such an armour is present in some species of *Alligator* (including¹ *Cayman* and *Jacare*) and absent in others, this feature would not of itself necessarily exclude the species from the former genus. Professor Huxley showed, moreover, that in having the upper teeth more numerous than the lower, the species differed from *Alligator* and agreed with *Crocodilus*; while the usual presence of a notch in the skull for the reception of the fourth lower tooth is a character of the latter genus. It will suffice to mention here that the cranium is characterized by the peculiar circumstance that the premaxillæ are united superiorly, and thus separate the nasals from the anterior nares.

The reader's attention must now be directed to the genus *Diplocynodon*, which was founded by Pomel² upon the lower jaw of an Alligatoroid Crocodilian from the Lower Miocene (Upper Oligocene) of Allier, which presented the peculiar feature of having the third lower tooth nearly as much enlarged as the fourth—from which feature the generic name was chosen. To the type specimen Pomel applied the name *D. Rateli*, and subsequently³ referred to the same genus the so-called *Alligator Hantoniensis*. Subsequently again H. von Meyer⁴ identified with this *D. Rateli* both a Crocodilian mentioned by Bravard from Allier under the name of *Crocodilus elaverensis*, and also others from the equivalent beds of Weissenau and other places in the Mayence basin to which he had previously applied the names *C. Rathi*, *C. Bruchi*, *C. medius*, and *C. Brauniorum*. At the same time Meyer observed that this form agreed with the so-called *Crocodilus Hastingsiæ* in the peculiar relations of the pre-maxillæ and nasals; and he consequently came to the conclusion that both were very closely allied, if not specifically the same.

At a much later period M. Vaillant⁵ described the Crocodilian remains from Allier and proposed for one form, in which the nasals reach the nares, the name of *Diplocynodon gracilis*; retaining that of *D. rateli* for the type mandible, which he regarded as probably distinct from his *D. gracilis*. His researches proved that *Diplocynodon* was furnished with ventral dermal armour.

In 1877 Herr Ludwig⁶ described and figured the Crocodilians from the Mayence basin, and re-named the form in which the nasals did not reach the nares *Alligator Darwini* (including in that species the

¹ I follow the views of Dr. Günther in this respect.

² Bull. Soc. Géol. France, ser. 2, vol. iv. p. 383 (1847).

³ Catalogue Méthodique, p. 124 (1853).

⁴ Neues Jahrbuch, 1857, p. 538.

⁵ Ann. Sci. Géol. vol. iii. art. 1 (1872).

⁶ Palæontographica, suppl. vol. iii. pt. 4.

four above-mentioned names previously applied by Meyer); while to another form, in which the nasals reach the nares, he gave the name of *Crocodylus Ebertsi*. Both forms show the enlarged third lower tooth characteristic of *Diplocynodon*, and from the equivalence of the Mayence and Allier deposits and the specific identity of many of their Mammals, the *primâ facie* presumption is that they are respectively identical with the two Allier forms.

Turning once more to the Hordwell Crocodylian, an examination of the skull figured by Owen in pl. vi. of his "Crocodylia, etc., of the London Clay" (Mon. Pal. Soc.), now in the British Museum (No. 30393), shows that it has the enlargement of the third lower tooth characteristic of *Diplocynodon*; and also that the smaller upper teeth bite on the outer side of the lower ones as in the Alligators, instead of interlocking with them as in the Crocodiles; and I therefore come to the conclusion that Pomel's reference of this species to *Diplocynodon* is correct, and consequently that it should be known as *D. Hantoniensis*. I should observe, moreover, that I think there is no doubt but that *Diplocynodon* is a valid genus, presenting the peculiar feature of the enlargement of the third lower tooth, but otherwise intermediate between *Alligator* and that group of *Crocodylus* comprising the existing Indian *C. palustris* and the fossil *C. Sivalensis*. As I shall allude more fully on a subsequent occasion to the distinctive features of the genus, I will only observe here that if it be not adopted it would be necessary to include both it and *Alligator* in *Crocodylus*.

With regard to the so-called *Alligator Darwini*, I cannot observe from the characters of the figured imperfect skulls any characters by which it can be distinguished from *D. Hantoniensis*; but since it occurs on a higher horizon it may be entitled to specific distinction, and I therefore propose that it should be provisionally known as *D. Darwini*; the specific name being adopted in preference to either of the four proposed by Von Meyer, which were never properly described or figured. With this form *D. Rateli*, Pomel, is probably also identical, but the unsatisfactory character afforded by the type renders it inadvisable to adopt this name. With regard to the so-called *Crocodylus Ebertsi* the figured cranium appears to me to show no characters by which it can be specifically distinguished from the younger type cranium of *D. gracilis* from Allier; the difference in the contour of the two being apparently merely due to the different ages of the two specimens.

It will be apparent from the above that all the so-called fossil Alligators of the Old World really belong to the genus *Diplocynodon*; and since the Crocodiles (*C. palustris* and *C. Sivalensis*) which approach nearest to this genus in the structure of the cranium and form of the maxillo-premaxillary suture on the palate are confined to India,¹ it becomes an interesting question to know whether the existing Alligator recently described from China may not show signs of affinity with *Diplocynodon*.

¹ See Lydekker, "Palæontologia Indica" (Mem. Geol. Surv. Ind.), ser. 10, vol. iii. p. 216 (1886).

London Clay Crocodilians.—Having concluded what I have to say in regard to *Diplocynodon*, I may mention that a comparison of the type skulls of the so-called *Crocodylus champsoides* and *C. toliapicus*, Owen, from the London Clay, has convinced me that these forms are nothing more than young and old individuals of a single species,¹ for which we should therefore adopt the original name *C. Spenceri*, Buckland.² The so-called *C. Arduini*, Zigno,³ from the Nummulitics of Verona, appears to be specifically indistinguishable from the English form.

The Wealden genus Hylæochampsæ.—In his sixth supplement to the Reptilia of the Wealden and Purbeck (Mon. Pal. Soc. 1873), p. 1, Prof. Sir R. Owen applied the name of *Hylæochampsæ* to the imperfect posterior part of the cranium of a small Crocodilian from the Wealden of Brook, which was figured in pl. v. figs. 23–25 of the preceding supplement of the same monograph. This specimen is new in the British Museum (No. R. 177), and differs from all other English Wealden Crocodilians by the extremely backward position of the posterior nares, which are situated immediately in advance of the pterygoids; and by the supratemporal fossæ being decidedly inferior in size to the orbits. It is further characterized by the orbits communicating freely with the lateral temporal fossæ⁴ as in recent Crocodilia, instead of being completely shut off from them as in the *Teleosauridæ*. Now the above features being those given by M. Dollo⁵ as characteristic of his so-called *Bernissartia*,⁶ the type of the family *Bernissartiidæ*, from the Wealden of Belgium, it becomes necessary to consider in what respects that form differs from *Hylæochampsæ*. On page 322 of his memoir M. Dollo observes that *Bernissartia* is distinguished from "*Hylæochampsæ* par l'absence de tout échancre orbito-latéro-temporale"; but as this statement is entirely erroneous,⁷ the one point of distinction which he indicates is invalid. As far, indeed, as I can see, the cranium of *Hylæochampsæ* appears to agree exactly not only in form, but also in size with that of *Bernissartia*, and I accordingly regard the two as specifically identical; in which opinion I have the support of my friend Mr. G. A. Boulenger, who has been good enough to compare the type specimen with M. Dollo's description and figure.⁸ Under these circumstances the name *Bernissartia Fagesi* must apparently give way to that of *Hylæochampsæ Vectiana*. The perfect preservation of

¹ Analogous modifications in a still more marked degree are exhibited in the three crania of the existing long-nosed *C. intermedius* figured by Lütken in the "Vidensk. Meddell," 1884, p. 61, pl. v.

² Woodward, GEOL. MAG. *op. cit.* p. 508.

³ Mem. Ac. R. Lincei, ser. 3, vol. v. p. 67, pl. i. (1880).

⁴ The "échancre orbito-latéro-temporale" of Dollo.

⁵ Bull. R. Hist. Nat. Belg. vol. ii. p. 334, pl. xiii. (1883).

⁶ *Ibid.* p. 222.

⁷ M. Dollo's statement was probably derived from Sir R. Owen's figures, but fig. 24 shows most clearly the vertical bar occurring in the middle of this vacuity; the rims of the parieto-frontal and quadrato-jugal regions having been broken away.

⁸ The *onus* of proving any distinction between *Hylæochampsæ* and *Bernissartia* now rests entirely with M. Dollo.

the Belgian specimens renders our knowledge of the affinities and structure of *Hylæochampsa* almost as well known as that of recent Crocodilians; and this we owe to M. Dollo's careful description.

The hinder portion of a Crocodilian skull with attached cervical vertebræ and dorsal scutes from the Wealden of Brook, preserved in the British Museum (No. 28966), appears to indicate a genus hitherto unknown in Britain. The vertebræ are amphicœlous, the scutes apparently without a peg-and-socket articulation, the orbits communicating with the lateral temporal fossæ, the posterior nares placed as in *Goniopholis*, the orbits only slightly smaller than the supratemporal fossæ, and the few remaining teeth small and slender. The whole contour of the skull is essentially Garial-like, and I have little doubt that it was produced into a rostrum. As far as I can see, it apparently agrees precisely with the skull figured in Dunker's "Mon. norddeutsch. Wealden," under the name of *Macrorhynchus Meyeri* (of which it is the type), although the palate of the latter is unfortunately not shown. Dr. Koken, who regards¹ *Macrorhynchus* as identical with *Pholidosaurus*, of the German Wealden, has, however, been good enough to send me a sketch of the palate of *Pholidosaurus Schaumburgensis*, which shows that the English specimen is generically identical with that form. The generic term *Macrorhynchus*, Dunker, which dates from 1844, is of later date than *Pholidosaurus*, and as it is preoccupied by Lacépède (1880) for a genus of Pisces, it cannot stand. Under these circumstances I propose to provisionally refer the English specimen to the second German species, which should be known as *Pholidosaurus Meyeri* (Dunker). This genus appears to bear the same relation to the existing Garials as is presented by *Goniopholis* to the Crocodiles and thus connects the former group with the typical *Teleosauridæ*; and I propose to include in the family *Goniopholididæ* all the Amphicœlian forms (e.g. *Hylæochampsa*, *Theriosuchus*, *Goniopholis*, *Petrosuchus*, and *Pholidosaurus*) in which the orbit communicates with the lateral temporal fossa; such family being divided into groups according to the position of the posterior nares, the form of the skull, and the nature of the armour; and occupying an intermediate position between the *Crocodilidæ* and the *Teleosauridæ*.

Classification.—In conclusion, I may observe, that since observations made subsequently to the publication of Prof. Huxley's classic memoir on the "Evolution of the Crocodilia" have tended to approximate his suborders Eusuchia and Mesosuchia, and to accentuate the distinction of the two from the Parasuchia, it appears inadvisable to continue to divide the Crocodilia into these three groups, which are certainly not of equivalent value; and I accordingly think it would be preferable, while retaining the suborder Parasuchia for those extremely generalized Crocodilians which show many points of kinship to other orders, to unite the other two groups in a single suborder which might be termed *Crocodilia Vera*. For the two sub-

¹ Zeitschr. deutsch. Geol. Ger. vol. xxxv. p. 824, note (1883). The suggestion here made that the vertebræ are proœlous has proved unfounded.

divisions of the latter, since it would perhaps be inadvisable to retain the names Eusuchia and Mesosuchia in a minor sense to their original usage, and as it is in many cases important to have a classification not depending solely upon cranial characters, I would adopt the earlier Owenian names to form a Proccelian and an Amphicoelian series. The former series would be characterized by the possession of proccelous vertebræ, and at least usually by the union of the pterygoids in a palatal plate below the narial canal. I add the saving clause in the last paragraph because it is highly probable that in some of the proccelous Crocodilia of the Cretaceous the pterygoids did not unite inferiorly.

The following table gives the grouping of the families under this scheme; the definition of the various groups being reserved for a future occasion.

- Order CROCODILIA.
 A. Suborder CROCODILIA VERA.
 a. Proccelian series.
 Crocodilidæ.
 b. Amphicoelian series.
 Goniopholididæ.
 Teleosauridæ.
 B. Suborder PARASUCHIA.
 Belodontidæ.
 Parasuchidæ.
 Stagonolepididæ.

P.S.—Since the above was in type I have received a memoir by Dr. Koken on the Crocodilia of the German Wealden (Paläontologische Abhandlungen, vol. iii. pt. 5, 1887), in which the skull of *Pholidosaurus* (*Macrorhynchus*) is figured. In this memoir the author has proposed precisely the same classification as that given above, although he adopts one or two more families, and has not proposed a name for the first suborder.

V.—ON A TEREBRATULA FROM THE UPPER CHALK OF SALISBURY.

By E. WESTLAKE, F.G.S.

THE two specimens figured below are from the collection of Mr. C. J. Read, of Salisbury, who obtained them from the Upper Chalk (Senonian) of the neighbourhood. Some uncertainty has attached to the exact locality, Mr. Read having told me that he had found them in the *Mucronata*-Chalk of Clarendon; but he now writes, 18th Jan. 1887—"My belief, on thinking the matter over, is that the right locality is the 'Devizes Road,' as they were originally marked." The locality referred to is Old Camp Down lime-pit, three miles N.W. of Salisbury on the Devizes Road. This pit is characterized by an abundance of *Micraster coranguinum* and *Echinoconus conicus*; but *Terebratula semiglobosa*, Sow., usually present in this zone, does not occur, and the only *Terebratulæ* we have found there are the two specimens figured. As the pit is seldom worked and we have no prospect of obtaining others, it has seemed best to describe them.