Batrachian and Reptilian Remains found in the Panchet Beds at Deoli, Bengal.

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Introduction.

The fossils described in this short note belong to the Panchet beds as developed at Deoli and are stored in the Geological Department of the Presidency College, Calcutta. Parts of these Panchet materials have already been described in two of my previous communications[1] and a further portion is dealt with here. The material includes (i) part of a labyrinthodont skull, (ii) a rhynchocephalian vertebra and (iii) a carnivorous dinosaurian tooth.

Labyrinthodont Skull.

(Pl. 11, figs. 1–3.)

The part of the labyrinthodont skull to be described is a portion of the right part of the skull containing a part of the maxillary and a part of the vomer. The maxillary portion shows only a number of alveoli from which the teeth have all fallen out, only the basal part of one tooth being preserved in the most anterior portion of the specimen. The portion preserved shows, besides the tooth mentioned just now, broken-off roots of four other teeth two of which are quite distinct and seven other sockets, the teeth from which have all fallen off. These sockets and the dental sections are quadrilateral and transversely elongated. The maxillary teeth are not all equidistant from one another. The dental section shows the dentine which is practically not folded and runs from the periphery towards the interior of the section. The maxillary teeth show no evidence of any pulp-cavity. The part of the vomer preserved shows that it is studded over with a large number of conical teeth each with a distinct pulp-cavity. The vomerine teeth are of unequal size and indiscriminately arranged.

Comparison:—The labyrinthodonts that have been described from the Indian Gondwanas are *Pachygonia*,[2] *Gonioglyptus*,[3]

[1] Sir A. Mukerjee Silver Jubilee Volume II, pp. 237–241, 1922. *Journ. Proc. Asiat. Soc. Bengal*, Vol. XXII, (N.S), pp. 215–217, 1926.
[2] *Pal. Ind.*, Ser. IV, Vol. I, pt. 1, pp. 6–8, 1865.
[3] *Ibid.*, Ser. IV, Vol.

Gondwanosaurus,[1] *Brachyops*,[2] *Glyptognathus*,[3] *Mastodonsaurus*[4] and a genus allied to *Metoposaurus*.[5] Parts of skulls showing the maxillary portions of *Gonioglyptus*, *Gondwanosaurus* and *Brachyops* are known but they are all distinct from the new specimen in the nature of the maxillary and the vomerine teeth. *Metoposaurus* and *Mastodonsaurus* are well-defined genera and quite unlike the specimen under discussion. As noted already, the most marked peculiarity of the specimen under discussion is the abundance of the vomerine teeth. According to the Committee of the British Association appointed to report on the classification of the labyrinthodonts, *Batrachiderpeton*, *Dendrerpeton*, and *Hylonomus*, are three genera characterised by aggregated vomerine teeth[6] while to the list may be added *Diplovertebron*, *Sparodus*, *Dawsonia*, *Acanthostoma* and *Melanerpeton*. Of these genera *Batrachiderpeton*[7] resembles the Panchet fossil in the arrangement of the vomerine teeth, but, as can be judged from the figure, Batrachiderpeton vomerine teeth lack a pulp-cavity, while this genus is further characterised by a probable 'deficiency of bony maxillæ.' *Hylonomus*[8] has also a large number of vomerine teeth, but the animal was of a size much smaller than that from the Panchet while the nature of the maxillary teeth is quite different. *Diplovertebron*[9] resembles the specimen under notice in the arrangement of the vomerine teeth but differs from it in the nature and arrangement of the maxillary ones. The maxillary teeth of *Sparodus*[10] are also of a quite different pattern, while in *Dawsonia*[11] the number of vomerine teeth is much smaller. In *Dendrerpeton*[12] also there is a number of vomerine teeth but the maxillary teeth are much smaller in size and of an entirely different pattern. *Acanthostoma*[13] and *Melanerpeton*[14] differ from the Panchet specimen by their different maxillary character and smaller size.

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[1] *Pal. Ind.*, Ser. IV, Vol. I, pt. 4, pp. 1–14, 1885.
[2] *Q. J. G. S.*, Vol. XI, pp. 37–39, 1855.
[3] *Rec. Geol. Surv. Ind.*, Vol. XV, p. 27, 1882.
[4] *Pal. Ind.*, Ser. IV, Vol. I, pt. 5, pp. 30–31. 1885; Catal. fossil Rep. and Amph. in British. Mus., Pt. IV, pp. 145–146, 1890.
[5] *Pal. Ind.*, Ser. IV, Vol. I, pt. 5, pp. 31–32, 1885; Catal. fossil Rep. and Amph. in Brit. Mus., Pt. IV, pp. 153–154, 1890; *Rec. Geol. Sur. Ind.*, Vol. 48, pp. 25–26, 1918.
[6] *Rep. Brit. Assoc. Adv. Sci.*, p. 176, 1879.
[7] *Ann. Mag. Nat. Hist.* Ser. IV, Vol. VI, pp. 56–65, 1870.
[8] *Zeit. d. deut. geol. Geselsch.* Vol. 37, p. 726, 1885.
[9] Fritsch: *Fauna der Gaskohle und der Kalkstcine der Permformation Bohemens*: Bd. II, pp. 11–13, 1883.
[10] Fritsch: *op. cit.*, Bd. I, pp. 84–88, 1883.
[11] Fritsch: *op. cit.*, Bd. I, pp. 89–92, 1883.
[12] Dawson: *Acadian Geology*, p. 365, 1868.
[13] Zeitschr. *d. deutsch. geol. Gesellsch.*, Vol. 35, pp. 277–289, 1883.
[14] *Ibid.*, pp. 289–293.

From these considerations it is quite clear that the Deoli specimen cannot be identified with any of the genera mentioned above and so I have to choose between two alternatives—namely to unite this, at least provisionally, with either of the genera *Pachygonia* or *Glyptognathus* known definitely only by parts of the mandible or create a new generic name for it. Union of the present specimen with *Glyptognathus* is not possible and, after a very careful consideration of the question, I have decided to unite it with *Pachygonia incurvata* and I have been led to this conclusion from the evidence (a) of the ornamentation which is of the same pattern in Huxley's type and in the specimen obtained by me and (b) of the width of upper part of the two jaws which is almost the same in both cases. The part of the labyrinthodont skull described here may, accordingly, be looked upon, at least provisionally, as belonging to *Pachygonia incurvata*. It may be mentioned that two parts of the cranium supposed to be of this species have already been described, one by Lydekker[1] and the other by the writer of the present note.[2]

Mandible of Pachygonia incurvata, Huxley.

While engaged in the study of the fragmentary part of the cranium, I had, with the kind permission of Dr. Heron of the Indian Geological Survey, an opportunity of examining the type mandible of *Pachygonia incurvata* and it appears that the description of this specimen as recorded by Prof. Huxley requires a little modification in the light of modern researches. The ramus of *P. incurvata* shows one row of teeth on the dentary while another piece described as splenial by Prof. Huxley 'exhibits minute, round, crater-like elevations ....., as if it had given attachment to teeth.'[3] It had been pointed out by Watson[4] that the bone described as the splenial in the stegocephalian mandible is really the coronoid. According to Williston,[5] in the primitive amphibia the coronoid is divided into three elements—pre-coronoid, inter-coronoid, and coronoid —and the splenial into two. In his most recent work dealing with the evolution and origin of the amphibia, Watson[6] also holds the same opinion regarding the tripartite division of the coronoid, but he names the different parts as Cor. I, Cor. II, and Cor. III anterio-posteriorly. A careful examination of the type-mandible of *P. incurvata* shows that the coronoid (the splenial of Huxley) is divisible into three

1 *Pal. Ind.*, Ser. IV, Vol. I, pt. 3, p. 19, 1879.
2 *Journal Asiat. Soc. Beng.*, Vol. XXII, pp. 215–217, 1926.
3 *Pal. Ind.*, Ser. IV, Vol. IV, pt. I, p. 7, 1865.
4 *Ann. Mag. Nat. Hist.*, Ser. 8, Vol. X, p. 586, 1912.
5 *Journ. Geol.*, Vol. XXII, pp. 416–419, 1914.
6 *Phil. Trans. Roy. Soc.*, Ser B. II, Vol. 214, pp. 226 *et. seq.* 1926.

parts—pre-coronoid, intercoronoid and coronoid. The pre-coronoid is incomplete in its anterior portion and bears crater-like elevations of distinctly two sizes; in the inter-coronoid the elevations are of a small size but are aggregated in its posterior part, while the coronoid does not contain any elevation at all. The splenial element is possibly represented by a very small fragment lying below the pre-coronoid, while the post-splenial element is quite large in size. The inner surface of the ramus is worn out and the junction between the other elements of the ramus are not so clear as to throw any additional light on its structure.

Rhynchocephalian Vertebra.

(Pl. 11, fig. 4.)

The collection includes one small vertebra which is pierced in the centre for the passage of the notochord. The body measures 10 mm. (?) anterio-posteriorly while the articular surface measures slightly more vertically than transversely. Both the surfaces are amphiplatyan rather than amphicœlous. Traces of both the neural and the haemal canals with points of attachment of one of the arches is present.

In his monograph dealing with the Panchet fossils, Prof. Huxley[1] described a few 'deeply biconcave' vertebrae identified as labyrinthodont vertebrae, though the possibility that they might have belonged to some type of fish is not lost sight of. The present vertebra is not amphicœlous, but rather amphiplatyan and is hence identified as a rhynchocephalian vertebra possibly belonging to the caudal series. The presence of a rhynchocephalian fossil in the Panchet stage is not unexpected as the Maleri stage is characterised by the presence of the well-known rhynchocephalian genus *Hyperodapedon*.

Teratosaurus (?) *bengalensis*, n. sp.

(Pl. 11, figs. 5–6.)

This provisional determination is based upon the evidence of a small conical tooth which is slightly curved posteriorly. Both the anterior and the posterior margins of the tooth are serrated, the anterior for only about a third of its length beginning from a little below the tip. The crest bearing the serrations on the anterior border is quite prominent. The serrations on the posterior margin begin practically from the tip and continue downwards along the entire length of the crown but the ridge bearing the posterior serrations is not so prominent as that on the anterior margin. The anterior

[1] *Pal. Ind.*, Ser. IV, Vol. I, pt. 1, p. 22, 1865.

Fig. 1. Part of labyrinthodont skull—inner aspect.

Fig. 2. Part of labyrinthodont skull—outer aspect.

Fig. 3. Vomerine teeth. X 4.

Fig. 5. Teratosaurus (?) bengalensis, n. sp. X 4.

Fig. 4. Rhynchocephalian vertebra. X 2.

Fig. 6. Teratosaurus (?) bengalensis, n. (base). X 4.

border is convex and there is a shallow depression occupying the anterior portion of the outer surface of the base, while the convexity of the outer surface which starts at the head of this depression is quite gradual. The concavity of the posterior border is also quite gradual. The base of the tooth is rather trapezoidal in outline with a pulp-cavity which penetrates for some distance. The serrations on the posterior border are more prominent than those on the anterior border, while the anterior serrations are set slightly more obliquely than the posterior ones. The crown is more or less cylindrical in shape.

Comparison:—From the Indian Gondwanas have been described *Epicampodon* (*Ankistrodon*) *indicum*, Huxley[1] and *Massospondylus Hislopi*, *Lyd.*[2] The present tooth differs from *Epicampodon indicum* in having both the edges serrated and curved, and being much longer in size. *Teratosaurus* (?) *bengalensis* differs from *Massospondylus Hislopi* as, in the latter, the teeth are much bigger, the serrations are continous on both the anterior and the posterior side, the outer surface is markedly convex and the inner one rather concave. This tooth may, however, be compared with the tooth described as *Palaeosaurus Fraserianus* Cope[3] obtained from the Triassic beds of Pennsylvania. According to v. Huene *Palaeosaurus Fraserianus* = *Thecodontosaurus Fraserianus*.[4]

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[1] Huxley: *op. cit.* pp. 11–13; Lydekker: *Catal. fossil Rept. and Amph. in the British Mus.*, Pt. I, p. 174, 1888.

[2] *Rec. Geol. Surv. Ind.*, Vol. 23, p. 22, 1890.

[3] *Proc. Amer. Phil. Soc.*, Vol. XVII, p. 232, 1878.

[4] *Geol. u Pal. Abhandl.*, Bd. XII, Hft. 2, p. 5, 1906. In this celebrated work dealing with the Triassic dinosaurs found outside Europe v. Huene has devoted a small paragraph (p. 51) to the Indian Triassic dinosaurs, but unfortunately I have not been able to follow some of his statements. He has pointed out that figure 4 of plate IV is not that of a dinosaur "klaue," but, it is, according to the author (Lydekker) 'the proximal portion of the right ulna' provisionally assigned to *Hyperodapedon Huxleyi*, Lyd. The author concludes with the following remarks :—

'Diese Zähne und Epicampodon stammen aus der triassichen Maleri Group, obwohl Lydekker zuerst meinte, sie seien aus der Lameta Group (=Kreide) von Maleri.' Two important corrections are necessary here. In the first place all these teeth did not come from the Maleri stage, but they came from two stages—Maleri and Panchet. In the second place, Lydekker never thought, as a matter of fact, could never think that all these teeth had come from the Lameta beds. As has been mentioned by Lydekker, only one of the teeth, that of *Massospondylus* (?) *Rawesi*, was from the Lameta beds and it has not been proved that this particular species does not occur in the Lametas. The point that was actually discussed by Lydekker regarding the age of the tooth was whether to put it under the inter-trappean or infra-trappean, and his conclusion that the age was infra-trappean has since been borne out by the discovery of carnivorous dinosaurian teeth in the Lameta beds of Jubbulpore by Dr. Matley (*Rec. Geol. Surv. Ind.*, Vol. 53, p. 153, 1921 and *Rec. Geol. Surv.*, Vol. 55, p. 105, 1923–24) and the writer of the present note. The name of *M. Rawesi* should, in reality, be expunged from the list given by v. Huene at p. 5.

Thecodontosaurus has a distinctly convex posterior border giving the crown a more or less lancet-shaped form which, however, is not characteristic of the tooth under notice. As regards the genus *Teratosaurus*, it may be mentioned that Lydekker recognised it as being identical with *Zanclodon*,[1] but this view has not been adopted by v. Heune who has described a number of teeth provisionally referable to *Teratosaurus*[2] and it is on a comparison of the present specimen with the figure published by him[3] that the proposed identification has been made, bearing in mind, however, that in cases of isolated teeth like the one described here, it is just possible that a dinosaurian tooth may be described as a parasuchian and *vice-versa* though, on general characters, the present tooth is of a dinosaurian rather than of a parasuchian type.

Age of the Panchet Beds.

In his paper dealing with the classification of the Gondwana system, Dr. Cotter has placed the Panchet beds under the lower Triassic age[4] disagreeing in this matter from Prof. Koken, according to whom the Panchets belong to the Upper Trias.[5] It is recognised by all that the lower Gondwanas comprise rocks of the Upper Palaeozoic and the lower Mesozoic age, as is shown clearly by the sections where they have come in contact with well-defined marine beds, as in parts of Kashmir and at Umaria in Central India, and further, by the presence of such well-known Permo-Triassic and Triassic genera as types of labyrinthodonts, some remains of *Lystrosaurus*, *Ceratodus* etc., but I doubt very much whether any sharp boundary between the different series can be drawn, as has been done by Prof. Koken in his paper and also by Dr. Cotter in his table so as to bring them exactly in line with the different divisions recognised in the standard stratigraphical scale, which is based mainly on the evidence of marine fossils. There is no stratigraphical break between the Raniganj and the Panchet series and a reference to the table showing the distribution of the lower Gondwana flora published by me[6] shows that 50% of the flora described from the Panchet beds have come up from the underlying Raniganj beds. Of the remaining 50% — four

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[1] *Catal. fossil Rept. and Amph. in the Brit. Mus.* Pt. 1, p. 171, 1888.
[2] *Geol. u Pal. Abhandl. Suppl.*, Bd. I, Lief. 3, pp. 155–177, 1908.
[3] See the text fig. 161 (p. 156) of the work above alluded to.
[4] *Rec. Geol. Surv. Ind.*, Vol. 48, pp. 23–33, 1917.
[5] *Neu. Jahrb. f. Min. Geol. u. Pal. Fest Band*, p. 483, 1907. The table given at this page shows the different views held by different authors regarding the age of the Panchet beds and among them Seward and Tschernyschew include these beds under the Permian.
[6] *Proc. Ind. Assoc. Cult. Sci.*, Vol. I, pp. 15–17, 1917.

species in all—two i.e., *Tanaeopteris cf. stenoneura*, and *Thinnfeldia cf. odontopteroides* are more of a Mesozoic type and of the other two genera, one (*Cyclopteris pachyrhacis*) is represented in the Barakar beds by the same genus but a different species, while the other fossil—*Pecopteris concinna*—may be Palaeozoic as the genus is chiefly a Palaeozoic one, though Mesozoic forms of this genus are not unknown.

The consideration of the plant fossils, accordingly, shows that it is not advisable to draw a Palaeozoic-Mesozoic boundary line between the Raniganj and the Panchet beds as has been done by Dr. Cotter and some other geologists. The part of the amphibian skull that has just been described does not show similarity with a Triassic labyrinthodont but the genera to which it shows resemblance are mainly Permian in age with the exception of two—*Batrachiderpeton* and *Diplovertebron*—which are from the Carboniferous beds. The Triassic labyrinthodonts have generally a very small number of vomerine teeth and when their number is large, they are arranged chiefly in definite lines, as has been found in *Buettneria*.[1] The presence of a carnivorous dinosaurian tooth shows that some parts of the bed are of a decided Triassic age. I am of the opinion that the view of Dr. Cotter that the Panchet beds are older than the Upper Trias is quite consistent with the evidence of fossils known to us, but from a consideration of the facts mentioned above I would be loath to draw a Palaeozoic-Mesozoic unconformity line between the Raniganj and the Panchet beds but would prefer rather to describe the Panchet beds as being of Permo-Lower Triassic age.

[1] Publication No. 321 of the Carnegie Institution of Washington, p. 15, 1922.