References.

Bagnall, R. S. 1918. "Records of some new British Diplopods and Pauropods, with a preliminary Check List of the British Myriapoda." Journ. Zool. Research, iii. pp. 87–93.

Brolemann, H. W. 1930. 'Elements d'une Faune des Myriapodes de France, Chilopodes.' [Pau : Brolemann.]

Evans, William. 1919. "On the Occurrence of *Glomeris perplexa* Latz., near Edinburgh ; with a Revised List of Forth Myriapods." 'The Scottish Naturalist,' May–June 1919, pp. 87–93.

Foster, Nevin H. Dec. 1919. "A List of the Myriapoda of Ulster." Ann. & Mag. Nat. Hist. (9) iv. pp. 395–407.

Latzel, Robert. 1880. 'Die Myriopoden der österreichisch-ungarischen Monarchie.' Erste Hälfte : Die Chilopoden. (Vienna : Hölder.)

Meinert, Fr. 1868. "Danmarks Scolopendrer og Lithobier." Naturh. Tidsskrift af Schiödte, Kjöbenhavn, 3. Række, v. pp. 241–268.

Godmersham,
Canterbury, Kent,
16th June, 1932.

XXIX.—*Relationships and Habitat of* Troödon *and the Nodosaurs.*

By C. M. Sternberg.

(Published by permission of the Director of the Geological Survey of Canada, Department of Mines, Ottawa.)

Relationship of Troödon.

In several of his important papers dealing with the classification of Dinosaurs, Baron F. Nopcsa has placed *Troödon* with the Armored Dinosaours (1, 2, 3). Gilmore has challenged (4, p. 31) the propriety of Nopcsa's latest assignment of this genus (3, p. 71), and shown, mainly from characters of the skeleton, that *Troödon* could not be included in the family Nodosauridæ. Nopcsa replied by contending that Gilmore's "*Troödon* (5) is an artificial mixture built up of the skull of a heavily-armoured quadrupedal and the body of an unarmoured bipedal Dinosaur" (6). More recently Russell (7) has shown the improbability of Gilmore's material representing more than one individual, and has confirmed Gilmore's assignment.

Russell has answered Nopcsa's contentions very well,

but there are a few points with reference to the osteology of the skull and teeth of *Troödon* and the Nodosaurs, which might be more fully stressed.

Nopcsa states that the skull of *Struthiosaurus* is built essentially on the lines of *Troödon*, but reference to his splendid figures of the specimen (3, Taf. i. figs. 1–4) shows no sign of a thickened parietal or frontal or a great backward extension of the occipital region which are so characteristic of the *Troödon* skull. The thick parieto-frontal mass seems unquestionably to be the result of a thickening of the cranial bones, and not the addition of dermal ossification as is the case with the Nodosaurs. In several specimens of *Troödon* which I have examined, the sutures between the frontals and between these bones and the parietals are distinctly shown from the brain-case to the surface, and in all specimens the sutures, between this dome-like mass and the other bones of the skull, show clearly throughout the thickness of the bone. Both Lambe (8) and Gilmore (4) have clearly illustrated this feature. In the Nodosaurs the sutures between the cranial bones are obscured, on the dorsal surface, by the dermal ossifications which cover them, but which do not coincide with them.

Another very important character is the presence of teeth in the premaxillæ. In even the more primitive members of the Stegosauroidæ the premaxillæ are edentulous. This character alone would seem to be sufficient to exclude *Troödon* from not only the Notosauridæ but the Stegosauroidæ.

Nopcsa states that the biology of the *Troödon* skull differs, as indicated by the structure of the teeth, essentially from that of all Ornithopoda. In 1925 I collected, from the Edmonton formation of Alberta, a nearly complete, articulated, skeleton of *Thescelosaurus* sp., in which part of the skull and the complete left mandibular ramus, with teeth, are preserved. This mandible compares very closely with Gilmore's figure of the mandible of *Troödon*, except that the anterior portion is longer and less steeply inclined. The teeth, on the other hand, more nearly resemble the mandibular teeth of *Edmontonia longiceps* (9), which is a typical Nodosaur, than do those of *Troödon*.

In Nopcsa's characterization of the Ornithopoidea (1, p. 184) he gives "teeth with enamel reduced at one side," whereas for the Thyreophoroidea he gives "teeth with multicuspid margin and striated crown." An examination of the teeth of *Thescelosaurus* shows that the above tooth-characters cannot be used for subordinal determination, for while *Thescelosaurus* is undoubtedly an Ornithopod the teeth have multicuspid margins, striated crowns, and both faces are enamelled.

All of the above-mentioned facts seem to confirm Gilmore's assignment of the genus *Troödon* to a distinct family of the Ornithopoda.

Habitat of Troödon.

The above-noted similarities between the teeth of certain Ornithopods and Nodosaurs might suggest similar food-habits, though field-studies point to different habitats for *Troödon* and the Nodosaurs. In the collections of various museums there are approximately forty specimens of the parieto-frontal mass of *Troödon* which were collected from Alberta. In one case the skull is complete and part of the skeleton is preserved, and in two or three others some other bones of the skull are present. The rest show more or less wear, as if they had been rolled along by water. This leads to the theory that these animals lived on the high ground and only the more durable portion of the skull usually withstood transportation to the delta deposits in which they were preserved. The great abundance of this portion of the skull indicates that *Troödon* was one of the most common Dinosaurs of its day, and had they lived in the swamps, or on the deltas, surely articulated skeletons would be in similar proportion to those of the Hadrosaurs, Nodosaurs, Ornithomimids, and Ceratopsians.

Habitat of Scolosaurus.

In his splendid description and restoration of *Scolosaurus cutleri* (2) Nopcsa assigns a desert habitat to this species and presumably to other members of the Nodosauridæ. His reasons for this assignment are largely the presence of a curled leaf and wind-blown sand in the abdominal cavity, and its resemblance to certain recent, desert

or semi-desert, reptiles. Eight years' field-work in the Belly River and Edmonton formations leads me to assign a lowland habitat to the Nodosaurs.

I visited the late W. E. Cutler when he was collecting the *Scolosaurus* skeleton, and am quite familiar with the beds from which it came.

The upper part of the Belly River series, from which *Scolosaurus cutleri* was collected, seems to represent purely delta deposits. The rocks consist mainly of greyish argillaceous sands and sandstones alternating with thick beds of greyish and dark clay and thin beds of ironstone. There is a great deal of false or cross-bedding and beds of fresh and brackish water shells, and the bones of Pleiosaurs are not uncommon. At various horizons throughout these beds are to be seen "bone beds." These appear to represent the shore-line of a lake, beach, or river, where disarticulated bones, logs, etc., have been washed up to a given level. These are often at the junction of sand and clay beds. One of these "bone beds" is to be seen a few feet above the *Scolosaurus* "quarry," and nearby and a few feet below is a thick bed of Unios.

I have collected or observed seven, more or less complete, articulated, skeletons of Nodosaurs in these beds, and, with one exception, all were buried upside down. This would be very unusual if the animal died in the desert, but if it died in the water or was picked up by a flood just when the gases had expanded the abdominal cavity, the heavy plates on the back would naturally cause the carcass to float upside down. The skeleton would remain in this position until it lodged on a sand-bar or sank to the bottom of the lake after the gases had escaped. Disarticulated skulls of horned Dinosaurs, in which the brow horns are large, are almost invariably found upside down, whereas if the lower jaws are attached they are often lying on their side. This would indicate that the heavy horns caused the skull to turn upside down as it floated. On the other hand, articulated skeletons of Hadrosaurs, which are so numerous in these beds, are usually found lying on their side.

The presence of some wind-blown sand might well be explained by suggesting that the carcass lodged on a sandbar during flood, but that later it was exposed to the sun and wind. While it is true that the recent spiny lizards, which Nopcsa mentioned, are desert or semi-desert dwellers, we also know that most of the broad-bodied short-limbed turtles inhabit swamps or streams.

References.

(1) Nopcsa, Baron F. 1928. 'Palæobiologica,' i. Band (1928).
(2) ——. 1928. 'Geologica Hungarica,' Ser. Pal. tomus i. fasc. 1 (1928).
(3) ——. 1929. 'Geologica Hungarica,' Ser. Pal. fasc. 4 (1929).
(4) Gilmore, C. W. 1930. Proc. U.S. Nat. Mus. vol. lxxvii. art. 16, pp. 1–39.
(5) ——. 1924. Univ. of Alta., Dept. of Geol. Bull. no. 1.
(6) Nopcsa, Baron F. 1931. Ann. & Mag. Nat. Hist. ser. 10, vol. viii. pp. 70–73 (July 1931).
(7) Russell, L. S. 1932. Ann. & Mag. Nat. Hist. ser. 10, vol. ix. pp. 334–7 (March 1932).
(8) Lambe, L. M. 1918. Trans. Roy. Soc. of Can. (3) vol. xii. sec. iv. pp. 23–26.
(9) Sternberg, C. M. 1928. Trans. Roy. Soc. of Can. (3) vol. xxii. sec. iv. pp. 93–106.

XXX.—*Report on a small Collection of Sponges from Stil Bay, S. Africa.*

By Maurice Burton, M.Sc., Assistant-Keeper, Department of Zoology, British Museum (Natural History).

The collection of sponges upon which the following report is based was made by Prof. T. A. Stephenson during the course of an ecological survey of Stil Bay, 200 miles along the coast eastwards from Cape Town. This collection, although small, affords a welcome addition to our knowledge of the South African sponges, and, as the section on distribution shows, indicates how important it is that the sponge-fauna of South Africa should be fully investigated.

Systematic List of Species.

Order CALCAREA.

Leucosolenia coriacea (Montagu).

Distribution.—Practically cosmopolitan.