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The occurrence of *Elasmosaurus* and *Polycotylus* in Russian deposits.\*

by

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It has been known for a long time that the surface deposits of North America contain a rich and varied fauna of plesiosaurs. Through the works of Leidy, Cope, Marsh, and other American paleontologists, there are established 17 genera and more than 30 different species, most of which are found in the Upper Cretaceous Period. Because of the desultory unsystematic character of paleontological literature, and also because of the insufficiency of many of the findings, thus far it has been most difficult to render a judgment in the matter of the American plesiosaurs. The works of American paleontologists have, for a long time, failed to find their merited esteem in Europe. For some time Williston has been doing work in re-examining and studying all remains of plesiosaurs found in North America. With the work of Williston<sup>(1)</sup> begins a new epoch in the study of Upper Cretaceous plesiosaurs, and there is opened up the possibility of comparing the American fauna with the European fauna. As one of his tasks, Williston sets

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<sup>(1)</sup> S. Williston. North American plesiosaurs. Part 1. *Field Columbian Museum Publication* 73. Chicago. 1903. — N. American plesiosaurs: *Elasmosaurus*, *Cimoliasaurus*, and *Polycotylus*. *The American Journal of Science* 1906, v. 21. — The skull of *Brachauchenius*. *Proceedings of the United States National Museum of Natural History*, v. XXXII; 1907. — N. American plesiosaurs: *Trinacromerum*., *Journal of Geology* 1908, v. 16.

out to give a detailed and definite analysis of the genera, according to complete skeletons. His studies, however, are not completed, and at present it cannot be said how many genera and species he will finally differentiate in the make-up of the American Upper Cretaceous fauna. Up to the present time he has succeeded in giving the characteristics of the following Upper Cretaceous genera:<sup>(2)</sup>

*Polycotylus*, Cope; *Trinacromerum*, Cragin; *Elasmosaurus*, Cope; *Cimoliasaurus*, Leidy; *Brachauchenius*, Williston [and Moodie].

It is remarkable that in this connection Williston agrees with Seeley who in 1892 because of their being closely enough characterized grouped them into the very same genera. *Polycotylus*, *Trinacromerum*, and *Brachauchenius* belong to the Brachydira; the first two genera stand very close one to the other and represent either one and the same genus or two subgenera of one genus. *Cimoliasaurus* and *Elasmosaurus* belong to the Elasmosauridae (Dolichodira). In spite of all the efforts of the investigators, *Cimoliasaurus* remains the least known genus of all. In the catalog of the British Museum (1889), this genus is given a downright disproportionate importance. *Elasmosaurus* belongs to a group of giants of the animal world, singular in its type of construction. This plesiosaur is in the first rank. There is a rather complete skeleton of an *Elasmosaurus platyurus*, Cope in the Museum of Natural Science at Philadelphia. The overall length of the animal is 42 or 45 feet, the neck takes up 23 feet and consists of 76 vertebrae. The other discoveries make it possible to conclude that some elasmosaurs were still longer, attaining 60 feet. The cataloged genera of plesiosaurs are found in the Senonian and to some extent the Turonian. There are discoveries of elasmosaurs from the Senonian of South America, where some important parts of a skeleton were found on the island of Quiriquina.<sup>(1)</sup>

In the Senonian of the isle of New Zealand, and in Australia, for some time there have been discoveries of bones in which it is possible to see remains of elasmosaurs and polycotyli.<sup>(2)</sup>

Now let us turn to Europe. In recent times Williston has ventured an opinion about the isolated position of the European fauna of plesiosaurs with reference to North America. On the basis of his investigations I arrived at opposite results and am ready to make an estimate as to the

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<sup>(2)</sup> H. G. Seeley. The nature of the shoulder girdle and clavicular arch in Sauropterygia. *Proceedings of the Royal Society of London*. 1892, vol. 51, p. 137.

<sup>(1)</sup> W. Deecke. Über Saurierreste aus den Quiriquina-Schichten. *Neues Jahrbuch für Mineralogie, Geologie, und Paläontologie Beilageband X*; 1895. Pp. 32–63. Pl. I–III (*Pliosaurus chilensis* Gay).

<sup>(2)</sup> I. Hector. On the fossil Reptilia of New Zealand. *Transactions Proceedings of the New Zealand Institute*, 1873; vol. VI. (*Maurisaurus haasti* Hec., *Pol. tenuis* Hec.). Pp. 333–351. Pl. XXVII–XXIX.

correlation between the European and American fauna. As is evident in various countries of Europe, the plesiosaur is found in the Gault and Cenomanian. The most important remains known are from England where they were described by Owen and Seeley, and from Russia where they were studied chiefly by Kiprijanoff. Besides the individual genus *Polyptychodon*, in this work are described the remains, mostly the vertebrae, of several species of plesiosaurs, but there have not been any great finds whatsoever. Owen attributes all the species to the genus *Plesiosaurus*. Kiprijanoff, in addition to *Plesiosaurus*, isolates also *Lütkesaurus*, a new genus that he established.<sup>(1)</sup> Kiprijanoff did not make a detailed analysis of *Lütkesaurus*, but we could quite definitely draw the limits of the given group of Cenomanian plesiosaurs and thereby extend the group somewhat. First of all it is necessary to say that the doubly bent vertebrae of *Lütkesaurus* coincide with the vertebrae of the type of *Ples. bernardi*, Owen (1964, *Plesichthyospondylus* Seeley). The teeth of *Lütkesaurus*, when compared with the teeth of *Polyptychodon continuus* Owen, differ in no respect. Worthy of attention is the placement of *Lütkesaurus* with the Thaumatosauri, i.e. into the group having short necks, or according to our terminology, the Brachydira. The said vertebrae and teeth of *Lütkesaurus*, quite as part and parcel, are described under this name<sup>(2)</sup>, and display a very great resemblance to the analogous bones of *Trinacromerum* and *Polycotylus*. Not having enough material at my disposal, I have not made up my mind about establishing more definitely the mutual relations between the above-mentioned European and American forms, but I surmise a greater affinity between these and others. The work of further investigations shows that *Lütkesaurus* is either an independent genus or one and the same genus with *Trinacromerum*. Besides the Brachydira, to which belong *Polyptychodon* and *Lütkesaurus*, there are known, in the form of small remains, also *Plesiosaurus* with long necks. A few vertebrae of this type from England are described by Owen. Here in Russia several vertebrae have been taken from the Kursh district. Kiprijanoff attributes these vertebrae to *Ples. helmerseni*, but in reality they belong to another species<sup>(3)</sup>. The genus is either identical with *Elasmosaurus* or is related to it. In view of the fact that in the Cenomanian of America there are no plesiosaurs, it is necessary to suppose that the American

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<sup>(1)</sup> W. Kiprijanoff. Stud. Foss. Reptil. Russl. III Theil. Gruppe Thaumatosauria aus der Kreideformation und dem moskauer Jura. *Mem. Acad. Imp. SPb.* VII S. T. XXXI, No. 6, 1883. P. 35, Pls. XV, XVII, XIX.

<sup>(2)</sup> Kiprijanoff. *Mem. Acad. Imp. SPb.* VII S. T. XXXI, No. 6. 1883. Pl. XIX, Fig. 1.

<sup>(3)</sup> Kiprijanoff. *Mem. Acad. Imp. SPb.* VII S. T. XXX; No. 6. P. 17. Pl. VII, Figs. 1, 2, 3; Pl. VIII, Figs. 1, 2, 3.

Upper Cretaceous fauna gets its origin from Europe. In the Turonian or perhaps toward the end of Cenomanian, the European seas were plesiosaur-poor.

Up to this time there have been known only scant remains of the plesiosaurs in the Senonian of Europe, very scant in England and slightly more in Sweden. In Russia from the Senonian of the Saratov district comes *Ples. helmerseni*, a species well-described by Kiprijanoff<sup>(1)</sup> and is unquestionably attributed to *Elasmosaurus*. *Elasmo. helmerseni* Kipr. because of its size was a relative of *E. platyrus* Cope and probably was longer than 40 feet. For the most part the vertebrae are known. A collection of the remains of plesiosaurs from the Senonian of the Saratov and Orenburg districts is located in the Geology Department of Moscow University. Following are definite species studied by me. In parentheses are shown the references to the paper "On the history of the plesiosaurs in Russia"<sup>(2)</sup> in which these remains are described.

Brachydira  
Polycotylidae

1. *Polycotylus* cf. *balticus* Schroder. Two posterior cervical vertebrae. (Table XII, Figures 9, 11; Figs. 10, 12). Orenburg district.
2. *Polycotylus latipinnis* Cope. First dorsal vertebra. (Table XVI, Figs. 2, 3). Saratov dist.
3. *Polycotylus (Trinacr.) orientalis* Bgl.  
Several cervical vertebrae. (Table XII; Figs. 1, 5, 7). Two dorsals. (Table XIII, Figs. 5, 6, 9, 10). Radiale. (Table XI, Fig. 4). Metacarpal. (Table XI, Fig. 5). Orenburg district.
4. *Polycotylus (Trinacr.) ultimus* Bgl.  
Two cervical vertebrae. (Table XII, Figs. 2, 3, 4, 6). Saratov district.

Dolichodira  
Elasmosauridae

1. *Elasmosaurus helmerseni*, Kipr. One caudal vertebra. (Table XIV, Fig. 6; Table XV, Fig. 6). Saratov district.
2. *Elasmosaurus orskensis*, Bgl. Several anterior cervical vertebrae. (Table XIV, Figs. 1, 2, 3; Table XV, Figs. 4). One posterior cervical vertebra (Table XV, Figs. 2, 3) of a much greater size. L = 135 num.; H = 100; W = 140. A fragment from a trunk or a posterior cervical vertebra. (Table XV, Fig. 1). A series of 5 very large caudal vertebrae. (Table XV; Fig. 5). Orenburg dist. This plesiosaur was probably about 50 feet in length.
3. *Elasmosaurus serdobensis*, Bgl. One cervical vertebra. (Table XV; Figs. 4, 5). Saratov dist.

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<sup>(1)</sup> Kiprijanoff. *Mem. Acad. Imp. SPb.* VII S. T. XXX, No. 6. P. 17, Pls. XI, XII, XIII.

<sup>(2)</sup> N. Bogolyenboff. Oocheniya Zapeeski I. M. U. Otd. yestyestven. eestoreech. Vyp. XXIX. 1911. (Scientific writings Imp. Moscow University, Dept. Natural History, Volume XXIX, 1911.)

4. To *Cimoliasaurus nazarowi*, Bgl. (Table XIII; Figs. 4, 8, 12) is attributed a very short cervical vertebra from the Orenburg district, somewhat resembling the vertebra of *Cimoliasaurus* sp. described by Deecke as coming from the Cenomanian of Chile<sup>(1)</sup>.

Of course, one should not attach an exaggerated importance to conclusions based upon very limited material, but, it appears to me, it is hardly possible to gainsay the presence of *Elasmosaurus* and *Polycotylus* in the Russian Senonian. Together with the remains of plesiosaurs, in these deposits are found remains of mosasaurs and the complete absence of any traces of ichthyosaurs.

In the Upper Cretaceous deposits of the Orsk in the Orenburg district together with vertebrae of plesiosaurs, there were found fragments of several propodial bones. As there are no direct data for explaining to which plesiosaur these long bones belonged, all this comes to mere conjecture. These bones have nothing in common with the very characteristic propodial bones that have been described recently by Williston. There remains *Polycotylus* and *Cimoliasaurus*. The proximal end of the bones displays a convex, articulating surface of a pear-shaped contour, which is divided by means of incisions into two parts, a larger part and a smaller one (Figure 2).

The tripartite character of the proximal [distal] end of the humerus [femur] in *Polycotylus* is well known. Here (Fig. 1) [in the proximal end] it is possible to distinguish the well-defined hemispherical part, the capitulum, and the transversely oval surface, the trochanter, separated from the capitulum by the deep groove. Hence the difference between the humerus [femur] of *Polycotylus* and the bones found is very clear. It is impossible to conjecture whether we have before us the femur of *Polycotylus*, regarding the construction of which we know nothing; perhaps the humerus of some species was constructed differently than the femur. [The femur alone shows a divided head in the Calif. specimen.] But even another supposition is possible, i.e. that the propodial bones belong to *Cimoliasaurus*. In this case the character of the proximal end of the propodial bones acquires the significance of an important systematic characteristic that makes it possible to distinguish *Cimoliasaurus* from *Polycotylus*. The construction of the proximal end of the long bones of the supposed *Cimoliasaurus* possibly could be explained as similar to its construction in the *Polycotylus*, which is composed of two parts. In *Polycotylus* (Fig. 1) the capitulum is separated from the trochanter by a deep groove, in *Cimoliasaurus* (Fig.

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<sup>(1)</sup> Deecke. *Neues Jahrbuch für Mineralogie, Geologie, und Paläontologie Beilageband X* (1895). P. 61. Pl. I, Fig. 5.

2) the capitulum and trochanter are joined in the general surrounding convex surface, and the boundary between the two parts is marked by the two lateral incisions, in front and behind. Pointing out at this point a possible answer to the problem, I do not in the least insist upon the accuracy of its solution. There are found together with the present bones distal ends of propodial bones constructed on the order of *Polycotylus*, with triple (or quadruple) elongated joint areas for the epipodial bones.

Proximal end of a long bone.

Fig. 1. Humerus [femur] of *Polycotylus*. At the top is the trochanter, at the bottom the capitulum, the two being divided from one another by means of a longitudinal groove.

Fig. 2. *Cimoliasaurus* (?)

Reduced by 1.5 times.