A New Giant Species of Edaphodon (Holocephali: Edaphodontidae) from the Beryozovaya Beds (Lower Paleocene) of the Volgograd Volga Region

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A New Giant Species of *Edaphodon* (Holocephali: Edaphodontidae) from the Beryozovaya Beds (Lower Paleocene) of the Volgograd Volga Region

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Abstract—A new species of giant chimaeroi *Edaphodon eolucifer* sp. nov. (family Edaphodontidae) from the basal horizon of the Beryozovaya Beds (Lower Paleocene, Danian) is described based on the lower jaw ("mandibular"), and anterior maxillary ("vomerine") dental plates hypothetically associated with the former. Accompanying assemblage of elasmobranch fish remains and invertebrates indicates that the remains of a newly described species were redeposited at the base of Paleocene from the Maastrichtian. Trends of morphological evolution of *Edaphodon* lower jaw dental plates during the Late Cretaceous and Paleocene are discussed.

INTRODUCTION

Remains of chimaeroid fishes of the family Edaphodontidae (Holocephali: Chimaeroidei): dental plates, less often ichthyodorulites and cephalic spines are rather abundant in the Upper Cretaceous and Paleogene deposits of the Volga Region (Popov, 1996; Nessov and Averianov, 1996). The genus *Ischyodus* Egerton, 1843 dominates over other family members in this region. Finds of often much larger fragmentary dental plates of *Edaphodon* Buckland, 1838 are much more rare. The study of a new fauna of chondrichthyan fishes from the Beryozovaya Beds (Lower Paleocene, Danian) in the Volgograd Volga Region (Yarkov & Popov, 1998) included collecting of chimaeroid material of the family Edaphodontidae, in particular of the genus *Edaphodon*. Lower jaw and anterior maxillary dental plates associated with them are described below as a new species *Edaphodon eolucifer* sp. nov.

MATERIALS

All material comes from the basal phosphorite horizon of the Beryozovaya Beds of the vertebrate locality "VRK" situated in the middle part of Krutoy Ravine, 1 km to the northwest of Rasstrigin farm in the Dubovka District, Volgograd Region. Apart from the new species described below the locality yielded as yet undescribed dental plates of chimaeroid fishes *Ischyodus "bifurcatus"* (probably, a new species), shark, skate and ray teeth: *Squalicorax pristodontus* (Agassiz), *Pseudocorax affinis* (Münster in Agassiz), *"Palaeohypotodus" bronni* (Agassiz), *Cretolamna appendiculata lata* (Agassiz), *Notidanodon* sp., *Scyliorhinus* sp., *Palaeogaleus* cf. *P. dahmani* Noubhani et Cappetta, *Plicatoscyllium minutum* (Forir), *Cederstroemia* sp., *Synechodus* cf. *S. lerichei* Herman, *Squalus* sp., *Heterodontus* cf. *havreensis* Herman, *Squatirhina* aff. *S. lonzeensis* Casier, *Squatirhina* sp., *Squatina* sp., *Ischyrhiza* aff. *I. avonicola* Estes, numerous spiral coprolites belonging to elasmobranchs, teeth and jaw fragments of teleosts *Enchodus* sp., *Ichthyodectes* sp., *Portheus* sp., *Polygyrodus* sp., *Belonostomus* cf. *B. cinctus* Agassiz, bone fragments and vertebrae of marine reptiles *Mosasaurus* aff. *M. hoffmanni* Mantell, *Mosasaurus* sp., *Dollosaurus lutugini* Yakovlev, *Plioplatecarpus marshi*, *Prognathodon* sp., *Liodon* sp., *Globidens* sp., turtles *Porthochelus* sp. (identifications of teleost fishes and reptiles made by one of the authors A.A. Yarkov), mollusc nuclei *Auriphillina* cf. *A. aurita* A. Ivanov, *Pycnodonte* sp., *Chlamys* sp., *Orbigonia* sp., *Venus* sp., *Volgella* sp., *Hyotissa* sp., *Entolium* sp., *Oxytoma* cf. *O. danica* Ravn, *Monticulina* sp.,? *Cyprina* sp., (identified by A.V. Ivanov, Research Institute of Geology, Saratov State University), phosphate shells of marinaculates, nuclei of belemnite phragmacones and fragments of phosphatized timber perforated by wood-borers. Skull roof bones, dorsal scutes and exoskeleton fragments of a large acipenserid fish *"Acipenser" gigantissimus* Nessov et Yarkov were previously described from the same locality (Nessov, 1997). All organic remains within this horizon were redeposited from the lower laying beds. These remains are phosphatized, fragmented and frequently pebbled to various degrees. The original age of the assemblage is dated as Maastrichtian based on elasmobranch fishes, reptiles and invertebrates.

Anterior maxillary dental plates were hypothetically associated with *Edaphodon eolucifer* sp. nov. lower jaw plates owing to the correspondence of their size, presence of these remains in the same layer within same locality and absence of dental plates of another *Edaphodon* species in this layer.

Terminology of dental plate surfaces used in the present paper is based upon recommendations of C. Patterson (1992). Additions were made in respect to

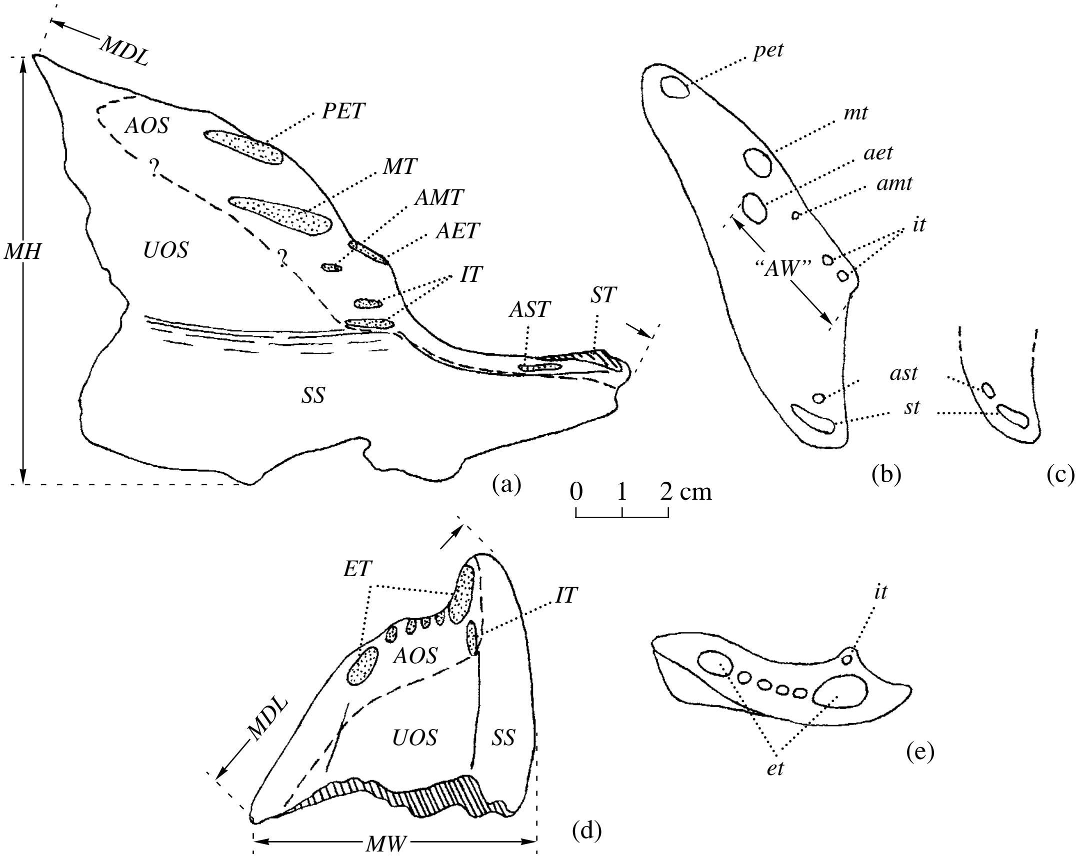

Fig. 1. Terminology and measurements of the lower jaw ("mandibular") and anterior maxillary ("vomerine") dental plates in *Edaphodon eolucifer* sp. nov., used in the text. (a)–(c) left lower jaw dental plate: (a) occlusal-symphysial view; (b) profile; (c) profile, a variation of interrelations between the symphysial and additional symphysial tritors (by specimen VOKM no. 30900/41); (d) and (e) right anterior maxillary plate: (d) occlusal-symphysial view; (e) profile. Designations: *AET*—anterior external tritor; *AMT*—additional mesial tritor; *AOS*—abraded part of the occlusal surface; *AST*—additional symphysial tritor; *"AW"*—"average width"; *ET*—external tritors; *IT*—internal tritor(s); *MDL*—mesio-distal length; *MH*—maximum height; *MT*—mesial tritor; *MW*—maximum width; *PET*—posterior external tritor; *ST*—symphysial tritor; *SS*—symphysial surface; *UOS*—unabraded part of the occlusal surface; *aet, amt, ast, et, it, mt, pet,* and *st*—pleromine masses showing at the occlusal surface of the plate as corresponding tritors; broken line marks the boundary between abraded and unabraded parts of the occlusal surface.

the terminology of occlusal surface (Figs. 1a and 1d). Some tritor names of the lower jaw and anterior maxillary dental plates are modified after E.T. Newton (1878) (Figs. 1a–1e). Terminology of hypermineralized tissue (pleromine), which composes the tritors is taken from T. Örvig (1985). Systematics of chimaeroid fishes follows D. Ward and Ch. Duffin (1989).

Described material is stored in the paleontological collections of the Volgograd Natural History Museum (VOKM).

SYSTEMATIC PALEONTOLOGY

Suborder Chimaeroidei

Family Edaphodontidae Owen, 1846

Genus *Edaphodon* Buckland, 1838

***Edaphodon eolucifer* Popov et Yarkov, sp. nov.**

E t y m o l o g y. From the Greek *eos* (dawn) and *lucifer*, a name commonly used for the Devil.

H o l o t y p e. VOKM, no. 30900/40, complete left lower jaw ("mandibular") dental plate; Volgograd Region, Rasstrigin farm, Krutoy Ravine, "VRK" locality; Maastrichtian, basal phosphorite horizon of the Beryozovaya Beds.

D e s c r i p t i o n (Figs. 1 and 2). Lower jaw ("mandibular") dental plates (Figs. 1a–1c and 2a–2c) are subtrapezoidally shaped when seen from the symphysial-occlusal side, laterally compressed and possess a well expressed beak. The following tritors are present: median, anterior and posterior lateral, 2 internal, 1 symphysial, 1 additional symphysial and 1 additional mesial. The last one is located mesially from the mesial tritor. The mesial tritor is no wider than the anterior and posterior external tritors. Internal tritors are rather narrow and extended parallel to each other. An additional mesial tritor is placed between the internal and mesial tritors, the former is no wider than the latter.

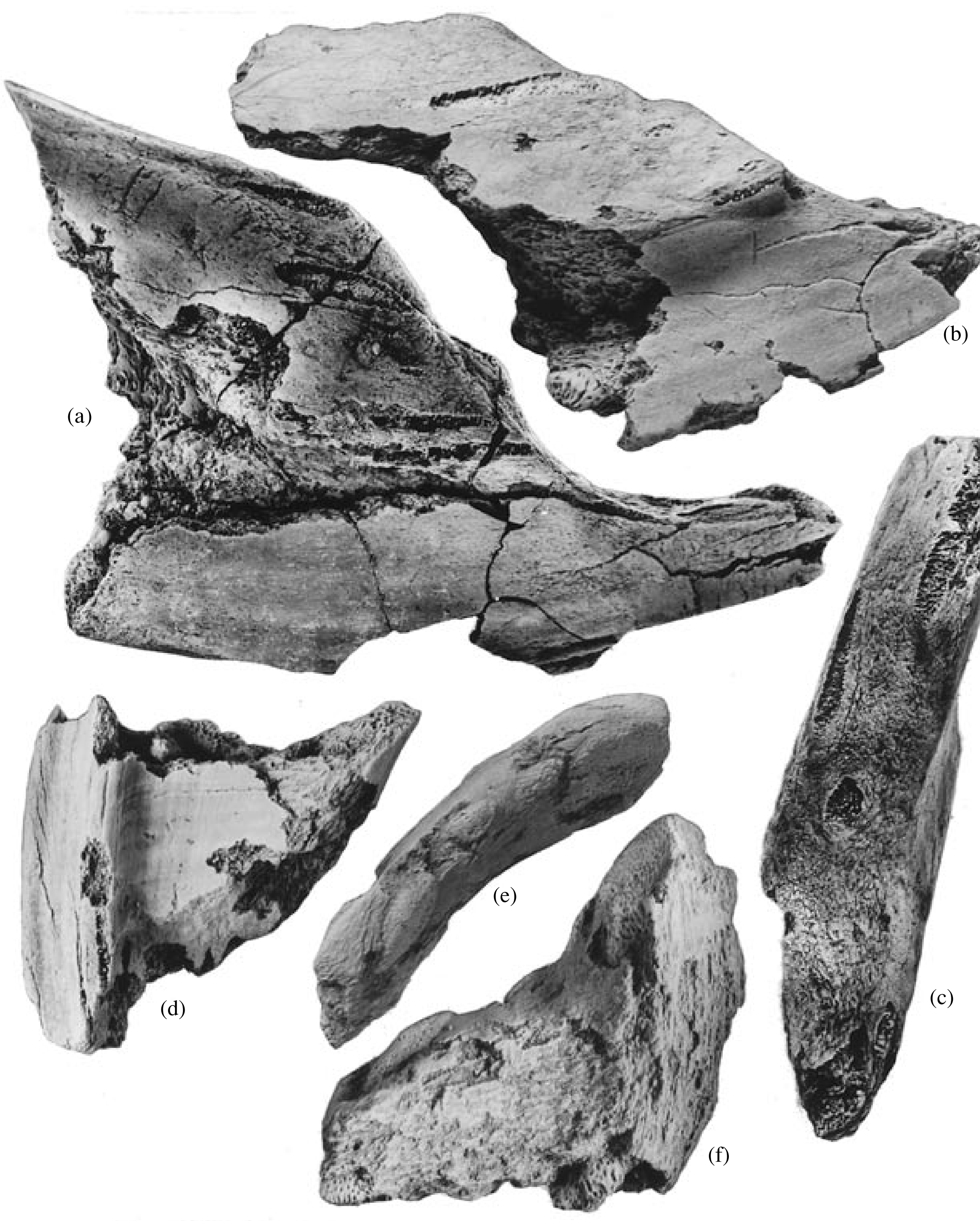

Fig. 2. Dental plates of *Edaphodon eolucifer* sp. nov., ×1.1; (a) holotype VOKM no. 30900/40, left lower jaw ("mandibular") plate, occlusal-symphysial projection; (b) specimen VOKM no. 30900/41, left lower jaw dental plate, symphysial-occlusal projection; (c) same specimen viewed from the occlusal surface; (d) specimen VOKM no. 30900/43, right anterior maxillary ("vomerine") dental plate, occlusal-symphysial projection; (e) specimen VOKM no. 30900/42, right anterior maxillary plate, occlusal-symphysial projection; (f) same specimen, labial projection.

Anterior maxillary ("vomerine") dental plates (Figs. 1d–2e and 2d–2f) are subtriangular when seen from the symphysial-occlusal side. From four to six external tritors run along the labial edge of the plate, the most mesial and distal of which are the largest. A narrow internal tritor may be present.

Posterior maxillary ("palatine") dental plates are unknown in this species.

Measurements (in mm):[1]

	MDL	MD	MW	"AW"
Holotype VOKM no. 30900/40147	147	86	–	21
Specimen VOKM no. 30900/41	109	79	–	20
Specimen VOKM no. 30900/42	72	–	52	–
Specimen VOKM no. 30900/43	67	–	53	–

Comparisons. The lower jaw plate of the new species differs from the most similar species *E. mantelli* (Agassiz) from the Cenomanian–Turonian and "Senonian" (White Chalk) of southern England (Agassiz, 1843, pl. 40a, fig. 2; Newton, 1878, pl. 4, figs. 2, 3 and 9) and the Lower Santonian of the Volga Region (Popov, 1999) by the presence of 2 parallel internal tritors and a small additional mesial tritor. Veritable anterior maxillary plates are unknown in *E. mantelli.* Lower jaw dental plates in *E. eolucifer* sp. nov. differ from those in *E. ubaghsi* Storms in Leriche from the Maastrichtian of the Netherlands and Belgium (Duffin and Reinders, 1995) by the absence of a wide mesial tritor subdivided in two branches mesially, and by the presence of an additional mesial and two internal tritors. Anterior maxillary dental plates in *E. ubaghsi* are also unknown. *E. eolucifer* sp. nov. differs from *E. gigas* (Egerton) known only from the anterior maxillary dental plates from the Turonian (Chalk) of southern England (Newton, 1878, pl. 5, figs. 1 and 2) by wider mesial and distal external tritors. Plates of the new species differ from the lower jaw plates of *E. sedgwickii* Agassiz from the "Neocomian–Senonian" of southern England (Newton, 1878, Pl. 1, figs. 1 and 2, Pl. 2, figs. 1, 8 and 10) by the absence of a wide mesial tritor fused to the internal tritor and the presence of an additional mesial tritor. Plates of the new species differ from the anterior maxillary ones in *E. sedgwickii* (Newton, 1878, Pl. 1, figs. 9 and 10) by comparatively wider distal external tritor. Besides that, from the anterior maxillary plates in *E. gigas* and *E. sedgwickii* the plates of the new species differ by a smaller number of external tritors on average (five–(?) seven in *E. gigas* and six in *E. sedgwickii*).

Remarks. *Edaphodon* anterior maxillary plates are usually less abundant than the other ones. This does not allow bulk collecting which complicates sufficient documentation of intraspecific variability of morphological elements (in particular, such features as number and relative width of external tritors). This reason, as well as design "conservatism" of this chimaeroid dentition element complicates confident comparison of anterior maxillary plates in various species, as well as topographically different plates within a jaw in one species (except in rare cases of associated finds of plates in the natural position or close to it).

E.T. Newton (1878) noticed that the anterior maxillary dental plates described as *E. gigas* probably belong to *E. mantelli* or *E. sedgwickii*. A.S. Woodward continued this idea. *E. gigas* is not treated as a separate species in his "Catalogue…" (Woodward, 1891). The reasons given above prevent confirmation of E.T. Newton's and A.S. Woodward's theories.

Dental material of *Edaphodon* from the Upper Cretaceous–Paleocene deposits of the Volga Region make it possible to trace gross tendencies in morphological evolution of the lower jaw dental plates in members of the genus. Similarly to the principle established for lower jaw dental plates of the chimaeroid genus *Ischyodus* (Popov and Ivanov, 1996; Ivanov, 1998), in *Edaphodon* morphological changes mainly affect shape and size of the median tritor, presence of additional tritoral elements and their fusion. However, evolutionary tendencies in the *Edaphodon* dental plates differ from those in *Ischyodus*. In *E. sedgwickii* typical of the Cenomanian the mesial edge of the mesial tritor is forked ("bifurcation"), the latter is mesially fused to the internal tritor. This species is replaced by forms with the dental plates possessing a narrow mesial tritor (*E. mantelli*, Lower Santonian). Geologically later forms are characterized by comparatively wider mesial tritor and a series of mesially placed additional mesial tritors (undescribed material from the Campanian). In the Maastrichtian the tendency towards reduction of a number of additional mesial tritors is observed, while the mesial tritor becomes narrow (*E. eolucifer* sp. nov.). An *Edaphodon* dental plate collected from the Lower Paleocene (Beryozovaya Beds, Danian) has a rather wide mesial tritor with slightly forked mesial edge, however this tritor is not fused to the internal ones and the plate bears no additional tritors. *Edaphodon* lower jaw dental plates are obviously most evolutionary variable and thus are most important diagnostically in comparison to the other elements of the jaw apparatus (similar peculiarity is also established by the authors for the lower jaw dental plates of another Edaphodontid genus *Ischyodus*). Thus, there is a discordance of evolutionary tendencies in the development of the lower jaw dental plates in *Edaphodon* and *Ischyodus* (Popov and Ivanov, 1996; Ivanov, 1998) during Late Cretaceous–Paleocene time interval in the Volga Region. *Ischyodus* and *Edaphodon* possessing morphologically similar dental plates were apparently involved in generally similar trophic chains. Most probably, the discrepancy of evolutionary tendencies described above reduced competition between members of these genera existing simultaneously in the same basin.

Material. Two lower jaw and two anterior maxillary dental plates (collected by A.A. Yarkov).

[1] MDL—mediodistal dental plate length; MD—maximum depth of the mandibular dental plate; MW—maximum width of the anterior maxillary dental plate; "AW"—"average width" of the mandibular dental plate.

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