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Eoteuthoidae – a new family of Late Cretaceous dibranchiate cephalopods (Coleoidea, Decapoda, Teuthina?)

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Abstract. On the basis of a uniquely preserved gladius of the Turonian coleoid cephalopod, the new genus *Eoteuthoides* Kostak, 2002, and the new family Eoteuthoidae fam. nov. are established. Designation of a new higher taxomomic unit is based on marked morphological differences from all known fossil taxa. *Eoteuthoides* shows strong affinities to some living families.

Key words: Upper Cretaceous, Cephalopoda, new taxa, Euteuthoidae

Introduction

Fritsch (1910) described four coleoid species – *Styloteuthis convexa* Fr., *Styloteuthis caudata* Fr., *Styloteuthis*? *vinarensis* Fr. and *Glyphiteuthis crenata* Fr. – from the Upper Turonian locality of Vinary near Vysoké Mýto (East Bohemia, Czech Republic). These species were critically reviewed by Kostak (2002). The genus *Styloteuthis* as employed by Fritsch included three species now thought to belong to different families and orders. They were placed in separate genera (*Styloteuthis* Fritsch, 1910; *Marekites* Kostak, 2002, and *Eoteuthoides* Kostak, 2002). Kostak (2002, p. 360, 363) mentioned the possibility of subsequent designation of a new family.

Results

Systematics

Class Cephalopoda Cuvier, 1795
Subclass Coleoidea Bather, 1888
Superorder Decapoda Leach, 1818
? Suborder Teuthina Naef, 1916

Family Eoteuthoidae fam. nov.
Type genus: *Eoteuthoides* Kostak, 2002.

The family Eoteuthoidae is designated on the basis of the monotypic genus *Eoteuthoides*. The establishment of this higher systematic unit on the basis of a single unique find is due to its marked morphological difference from all other known fossil taxa.

Diagnosis: The family Eoteuthoidae is characterized by the modern aspect of the gladius. The straight rhachis passes into lateral vanes. The vanes are broadest approximately halfway along the length of the gladius. Anterior margins of the vanes are partly inrolled (compressed in the fossil specimen) posteriorly from the point of greatest width. The narrowest part of the vanes is just behind the posterior inrolled vanes, and could form a small tubular conus at the apex. No asymptotes are developed in the vanes.

Differences: The Eoteuthoidae differ from all fossil representatives of Prototeuthina Naef and Mesoteuthina Naef (see Naef 1922, Jeletzky 1966, Riegraf 1995, Riegraf et al. 1998) in having anterior and posterior vanes which are derived from the rhachis, in the different character of the gladius and in different original mineralogy. No asymptotes or growth lines are developed. The family shows more similarities to Recent teuthids of the family Promachoteuthidae Hoyle with respect to the shape and character of the gladius (see Toll 1982; Pl. 33). Also, the size of the *Eoteuthoides* gladius is comparable with some taxa of Promachoteuthidae (Toll, 1982 – *Promachoteuthis megaptera* Hoyle, Pl. 33A, p. 275–278 and *Promachoteuthis* B?, Pl. 33C, p. 279–281). The shape of the gladius closely resembles *Promachoteuthis* sp. A? (see Toll, 1982, Pl. 33B), Fig. 1, although *Eoteuthoides* is markedly smaller. It differs slightly from other taxa of Promachoteuthidae in having greater contrast between the anterior and posterior vanes. The posterior vanes expand markedly in *Eoteuthoides*. The gladius of Eoteuthoidae also slightly resembles some representatives of the family Gonatidae Hoyle – genera *Gonatus* Gray (*G. middendorffi*, *G. borealis* and *G. japonicus* – Toll, 1982; Pl. 26) and *Berryteuthis* Naef (*B. magister* – Toll, 1982; Pl. 27). Eoteuthoidae differ in having more expanded anterior vanes and especially in having a distinctly smaller gladius (a few tens of mm in *Eoteuthoides* against a few tens of cm in the above-mentioned species of Gonatidae).

Eoteuthoides cannot be placed to any existing fossil family, and it is evident that this late Cretaceous genus cannot either be placed in any Recent family (the age difference is about 90 Ma). For this reason the recognition of a new family seems to be justified.

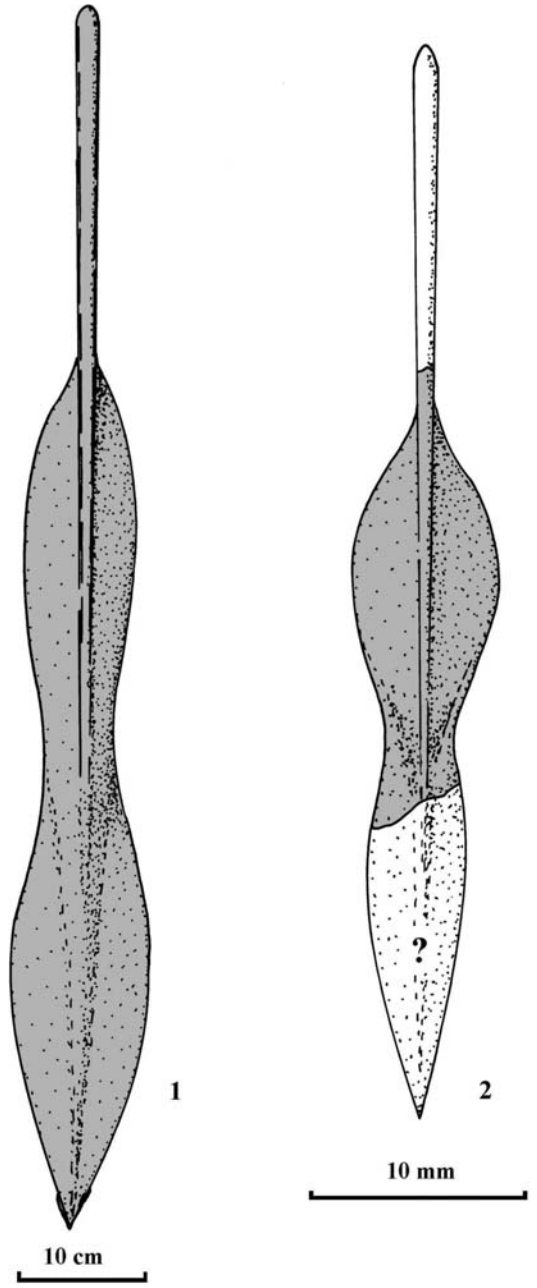

Fig. 1. 1 – Gladius of *Promachoteuthis* sp. A? – family *Promachoteuthidae* Hoyle (after Toll 1982). 2 – Reconstruction of *Eoteuthoides* gladius – preserved part is shown in grey.

Genus *Eoteuthoides* Kostak, 2002
Type species: *Styloteuthis caudata* Fritsch, 1910.

Diagnosis: Small teuthid with free rhachis. Anterior and posterior vanes are developed. Vanes are smooth without asymptotes or growth lines. Anterior vanes are long and wider than posterior vanes. Posterior vanes are inrolled. Gladius is secondarily phosphatized (see also Kostak 2002).

Eoteuthoides caudatus (Fritsch, 1910)
Fig. 2

1910 *Styloteuthis caudata* Fritsch, p. 13, Tab. 5, fig. 2.

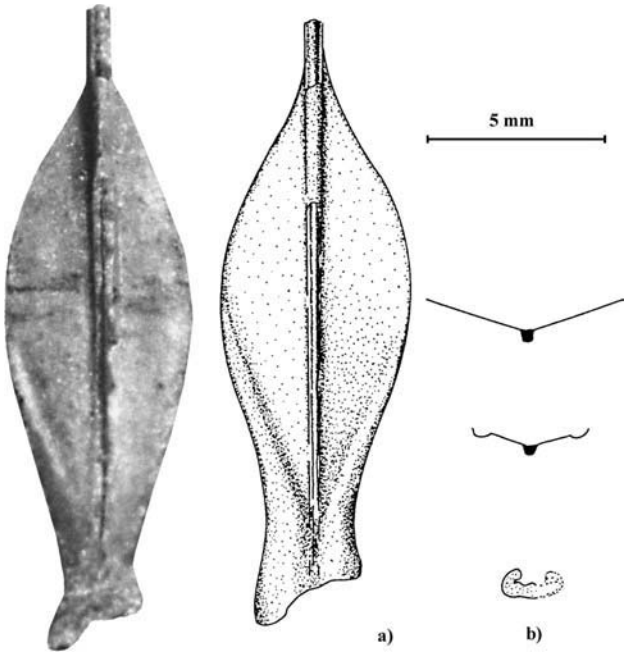

Fig 2. *Eoteuthoides caudatus* (Fritsch). Specimen No. O3222, National Museum, Prague. a – dorsal view, b – cross section (after Kostak, 2002).

1920 *Styloteuthis caudata* Fritsch, Bülow-Trummer, p. 251.
1922 *Styloteuthis caudata* Fritsch, Naef, p. 119.
1995 ?*Styloteuthis caudata* Fritsch, Riegraf, p. 150.
2002 *Eoteuthoides caudata* (Fritsch), Kostak, p. 363–364, text fig. 4, Tab. 1, fig. 5.

Short description: The single well-preserved specimen (holotype No. O3222 kept in the National Museum, Prague) comprises the greater part of a very small, 18 mm long phosphatized gladius. The preserved part of the free rhachis is short and 0.8 mm in width. The rhachis expands laterally into thin smooth lateral areas – vanes. No asymptotes or growth lines are developed. Two bands are developed along the vanes. The anterior band is thin: it rises along the antero-lateral vane margin at the point of greatest width of the anterior expanded portion. This band expands through the constricted portion towards the posterior part and continues to the poorly preserved inrolled vanes in the expanded posterior portion. It is not entirely clear whether a small tubular conus formed the apex because of incomplete preservation. However, the existing remains strongly suggest such a structure (see Fig. 2).

Stratigraphic range: Upper Cretaceous, Upper Turonian (Jizera Formation sensu Frič 1885);

Geographic distribution: Czech Republic (Bohemian Cretaceous Basin), East Bohemia, Vinary near Vysoké Mýto.

Remarks on gladius mineralogy

The gladius of *Eoteuthoides* Kostak is not mineralized by aragonite as in *Styloteuthis* Fritsch and *Marekites* Kostak which were found together with *E. caudatus* at the same lo-

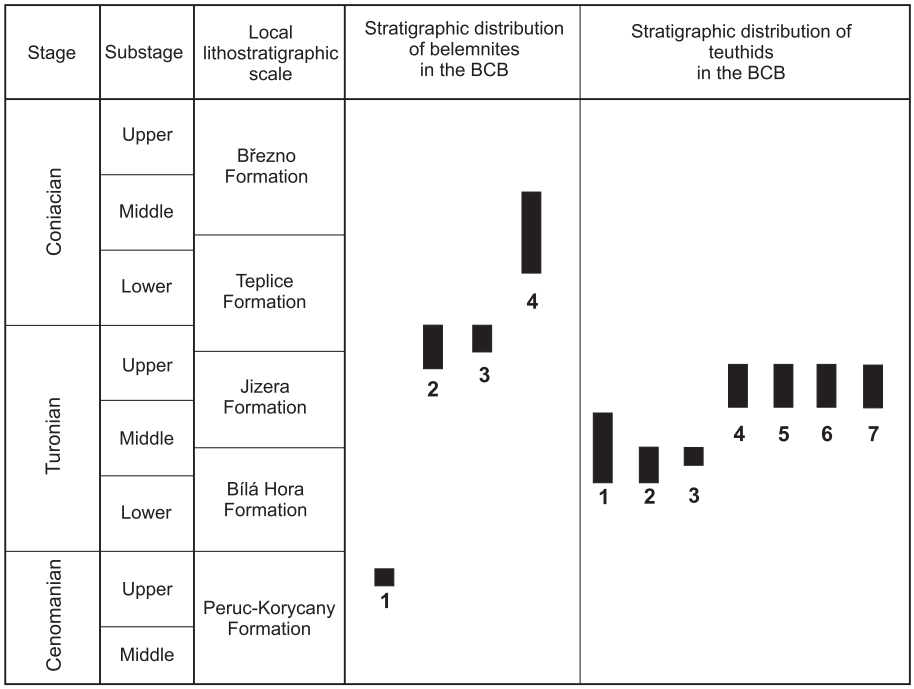

Fig. 3. Coleoid diversity, stratigraphy and the relation between the appearances of belemnites and teuthids in the Bohemian Cretaceous Basin: Belemnites (Belemnitellidae): 1 – *Praeactinocamax plenus* (Blainville). 2 – *Praeactinocamax bohemicus* (Stolley). 3 – *Praeactinocamax* aff. *bohemicus* Košťák. 4 – *Goniocamax lundgreni* (Stolley). Teuthids: 1 – *Glyphiteuthis ornata* Reuss. 2 – *Glyphiteuthis minor* Fritsch & Schlönbach. 3 – *Glyphiteuthis* sp. cf. *G. minor* Fritsch & Schlönbach. 4 – *Paraglyphiteuthis crenata* (Fritsch). 5 – *Marekites vinarensis* (Fritsch). 6 – *Styloteuthis convexa* (Fritsch). 7 – *Eoteuthoides caudatus* (Fritsch). After Kostak (2002).

cality, stratigraphical level, and in the same type of sediment. Under the microscope deformations visible on the margins of the vanes indicate an original elasticity. Hewitt and Wignall (1988) concluded that the original mineralogy of *Trachyteuthis* Meyer, from the Solnhofen Formation, was francolite. Doyle (1991) described a specimen of *Trachyteuthis* from Antarctica which was also phosphatic but he did not rule out the possibility of diagenetic replacement of original aragonite. It is quite difficult to explain the different mineralogy (phosphatic in *Eoteuthoides,* aragonite in *Styloteuthis* and *Marekites*) in the same type of sediment at the same place by selective mineralization. Aragonite of the gladii of *Styloteuthis* and *Marekites* seems to be original. The gladius of *Eoteuthoides* was probably originally conchiolinic and has been secondarily phosphatized.

Remarks on the occurrence of teuthids in the Bohemian Cretaceous Basin

Rich and diverse teuthids have been reported from the Upper Cretaceous of North America (Miller 1957, Miller and Walker 1968, Green 1977, Nichols and Isaak 1987; though Stewart 1976, considered the number of genera recognized to be excessive) and from Lebanon and Syria (Roger 1946, 1952, Engeser and Reitner 1986, more recently by Novati 2002).

Late Cretaceous teuthids are very rare in the Central European biogeographical Subprovince. They occur in the Lower to Upper Turonian interval in the Bohemian Cretaceous Basin (Košťák 1999, Kostak 2002). Their occurrence and radiation were probably induced by large palaeoclimatic and palaeoecological changes in this area and also by reduction in the diversity of belemnites during this time interval. The Lower and Middle Turonian is characterized by the lowest diversity of belemnites in the Central European biogeographical Subprovince (Christensen 1976). Belemnites became more diverse here in the Late Turonian but are very rare (Christensen 1982, Košťák 1996). Coleoid diversity, stratigraphy and the relation between belemnites and teuthoid occurrences in the Bohemian Cretaceous Basin are shown in Fig. 3.

Radiation of teuthoids began at the Early/Middle Turonian boundary and continued to the Late Turonian in the Bohemian Cretaceous Basin. The occurrence and supposed radiation of teuthids during this time are not connected with sedimentary preservation potential; they occur in different types of sediments – i.e., glauconitic sandstones, glauconitic marlstones, calcareous and quartzite marlstones.

Conclusions

The presence of *Eoteuthoides,* much like *Styloteuthis* and *Marekites,* in the early Late Turonian in the Bohemian Cretaceous Basin proves the existence of modern teuthid-like forms about 90 My ago. Teuthids with stylishly shaped gladii were in existence in the Late Turonian. The Eoteuthoidae seem to be the earliest known ancestors of some present teuthid cephalopods.

Engeser and Bandel (1988) mentioned that the radiation of higher decapods probably took place in the Early Tertiary quite some time after the belemnoid coleoids became extinct. It is clear that this radiation began sooner – in the Late Cretaceous, probably in areas with virtual absence of belemnoid coleoids.

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