A unique late Eocene coleoid cephalopod *Mississaepia* from Mississippi, USA: New data on cuttlebone structure, and their phylogenetic implications

Larisa A. Doguzhaeva, Patricia G. Weaver, and Charles N. Ciampaglio


A new family, *Mississaepiidae*, from the *Sepia–Spirula* branch of decabrachian coleoids (Cephalopoda), is erected on the basis of the following, recently revealed, morphological, ultrastructural and chemical traits of the cuttlebone in the late Eocene *Mississaepia*, formerly referred to *Belosaepiidae*: (i) septa are semi-transparent, largely chitinous (as opposed to all other recorded cephalopods having non-transparent aragonitic septa); (ii) septa have a thin lamello-fibrillar nacreous covering (*Sepia* lacks nacre altogether, *Spirula* has fully lamello-fibrillar nacreous septa, ectochochlate cephalopods have columnar nacre in septa); (iii) a siphonal tube is present in early ontogeny (similar to siphonal tube development of the Danian *Ceratisepia*, and as opposed to complete lack of siphonal tube in *Sepia* and siphonal tube development through its entire ontogeny in *Spirula*); (iv) the lamello-fibrillar nacreous ultrastructure of septal necks (similar to septal necks in *Spirula*); (v) a sub-hemispherical protoconch (as opposed to the spherical protoconchs of the Danian *Ceratisepia* and Recent *Spirula*); (vi) conotheca has ventro-lateral extension in early ontogenetic stages (as opposed to *Sepia* that has no ventro-lateral extension of the conotheca and to *Spirula* that retains fully-developed phragmocone throughout its entire ontogeny). Chitinous composition of septa in *Mississaepia* is deduced from (i) their visual similarity to the chitinous semi-transparent flange of *Sepia*, (ii) angular and rounded outlines and straight compressive failures of the partial septa and mural parts of septa similar to mechanically-damaged dry rigid chitinous flange of *Sepia* or a gladius of squid, and (iii) organics consistent with –chitin preserved in the shell. The family *Mississaepiidae* may represent a unknown lineage of the *Sepia–Spirula* branch of coleoids, a conotheca lacking a nacreous layer being a common trait of the shell of this branch. However, *Mississaepiidae* is placed with reservation in Sepiida because of similarities between their gross shell morphology (a cuttlebone type of shell) and inorganic–organic composition. In *Mississaepia*, as in *Sepia*, the shell contains up to 6% of nitrogen by weight; phosphatised sheets within the dorsal shield may have been originally organic, like similar structures in *Sepia*; accumulations of pyrite in peripheral zones of aragonitic spherulites and in-between the spherulites of the dorsal shield may also indicate additional locations of organics in the shell of living animal.
Key words: Cephalopoda, Coleoidea, cuttlebone, lamello-fibrillar nacre, chitin septa, fossilization, Eocene, Mississippi, USA.

Larisa A. Doguzhaeva [larisa.doguzhaeva@nrm.se], Department of Palaeozoology, Swedish Museum of Natural History, P. O. Box 50007, SE-104 05 Stockholm, Sweden; Patricia G. Weaver [trish.weaver@gmail.com], North Carolina Museum of Natural Sciences, 11 West Jones Street, Raleigh, NC 27601-1029, USA; Charles N. Ciampaglio [chuck.ciampaglio@wright.edu], Department of Geology, Wright State University-Lake Campus, 7600 State Route 703, Celina, OH 45822, USA.

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