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Fossilized gill soft tissues in Mesozoic freshwater unionoid bivalves: reinvestigation and new evidence of the evolution of adaptation to the freshwater environment

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Large freshwater unionoid bivalves today are a globally distributed and diverse group, with a history dating back to the Triassic. Their evolutionary success largely depends on their reproductive behavior, today, they all take maternal care via brooding their embryos, which is only possible in the modified (advanced) eulamellibranch gills, facilitating survival in freshwaters. It can be expected that such an essential trait could have originated in the last common ancestor of advanced Unionida lineages sometime after Carnian, Late Triassic, where unionoids with filibranch gills were known, and before the Middle Jurassic, when advanced unionoids already existed. The gill anatomy of unionoids, because of their calcified gill filaments, enhances exceptional preservation of associated soft gill tissues. New Late Triassic unionoid materials from Poland with gill tissues preserved, *Silesunio parvus*, *Tihkia silesiaca*, *Tihkia* ? sp., together with other Mesozoic materials from archival collections from Cretaceous of United Kingdom ("*Unio porrectus*") and Brazil (*Anodontites freitasi*) provide new insights into gill evolution in Unionida. The traits observed during surface investigation supported a filibranch trait in the gill anatomy of *S. parvus* and *Tihkia*? sp. indicating the origin of evolving advanced gills took place after the Triassic. Yet, the eulamellibrach anatomy was confirmed only in Late Cretaceous *A. freitasi*. The preservation of the gills in the remaining specimens studied does not provide new data on the origins of advanced gills in unionoids and its more detailed timing.

Key words: Unionida, brooding, soft tissues, gill anatomy, freshwater, Triassic, Cretaceous, Mesozoic.

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