Post-larval and larval shells of *Juranomia* FURSCH & WERNER 1989, and *Anomia* LINNAEUS 1758 (Anomiidae, Bivalvia)

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With 4 figures and 1 table

**Abstract:** Post-larval and larval shells of *Juranomia calcibyssata* from the Bathonian to Callovian of Poland and Recent *Anomia membranacea* from the Mediterranean are described and compared to other fossil and Recent members of the family Anomiidae. The stratigraphic range of the monospecific genus *Juranomia*, which, up to now, was only known from the Kimmeridgian, can be extended to include the Lower Bathonian. The state of preservation of the fossil species allows recognition of an internal aragonitic, branching and complex cross-lamellar shell layer in the post-larval left valve, which was previously only assumed to be present. *Anomia membranacea* is a member of the *A. ephippium* lineage as proved, among other characters, by the presence of an outer calcitic prismatic layer in its right valve. It possesses an anterior pedal retractor in the left valve, which, in the original discussion of the phylogenetic affinities of *Juranomia*, was thought to be lacking in species of *Anomia*. Consequently, the genera *Juranomia* and *Anomia* only differ in two important shell characters: closeness or distance between the three central muscles and thickness of the inner aragonitic shell layer of the left valve.

Larval shells of *Juranomia* are similar to those of Recent anomids in shape, size, the presence of a byssal notch in the right valve, and an external sinus and internal shelly process in the left valve. The last three features are parts of a single character which is considered as an autapomorphy of the stem species of the Anomiidae. The small P1 size of *Juranomia calcibyssata* suggests a purely planktic-planktotrophic development and thus, high potential of dispersal, just as its modern counterparts.Irrespective of the general similarity in shell size, the mean dimensions of the PII are likely species-specific.

**Introduction**

Up to date, the monospecific genus *Juranomia* FURSCH & WERNER 1989 was only known from the Lower and Upper Kimmeridgian of the Lusitanian Basin of central Portugal. The same taxon has now been found in Lower Bathonian to Middle Callovian sediments in northwestern Poland testifying a much wider geographic and temporal distribution than previously known of the genus. The state of preservation of the Polish specimens permits, among other features of the post-larval shell, the study of original aragonitic microstructures and muscle attachment scars. In addition, larval shells, previously unknown from fossil anomids, are described for the first time. This new information allows a better comparison with other fossil and living Anomiidae and leads to a re-evaluation of the original diagnosis of *Juranomia*. The comparison...
Living _Anomia membranacea_ LAMARCK 1819 were collected in the bay of Banyuls (northwestern Mediterranean, France) in 1998. More than twenty complete, post-larval specimens were obtained from PVC tubes that served to collect byssally attached and cementing bivalves. The tubes were retrieved monthly between May and September. Some other specimens are from sediment samples and plankton hauls.

_[Diagram of shell dimensions]_

of prodissocochns is especially interesting, because it reveals whether larval shells can be used for taxonomic identification and whether morphological characters, shell sizes (Fig. 1) or reproduction strategies changed in the course of anomoid evolution.

The figured specimens are deposited in the Bundesanstalt für Geowissenschaften und Rohstoffe in Berlin (BGR X10830 to X10837).

**Material and Methods**

Forty, almost complete, left valves of _Juranomia calcibyssata_ FURSICH & WERNER 1989 were examined. The specimens are determined on the basis of the original description. They belong to a rich mollusk fauna from Middle Jurassic subsurface sediments near the village Kleby (= Klemmen, about 50 km NNE of Szczecin, Poland). The fauna was obtained during an exploration drill campaign in 1937 when Further Pomerania was part of Germany (see BROCKAMP 1941, for a summary of drill activities). The material is now located in the collection of the Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) in Berlin. The biostratigraphic framework, which is based on ostracods, is adopted from GRÜNDEL (1997, and pers. commun.) who extensively studied the larval and post-larval gastropods of these sediments. Details on the ostracod fauna remain unpublished so far.

Ten nearly complete post-larval valves of _Juranomia calcibyssata_ were chosen for examination under an SEM. Only some of them had the larval shell sufficiently well preserved for description and measuring. In addition, parts of the prodissocochn I (P I) are always hidden by post-larval shell material which prevents measurement of the height. Breaking of the dorsal shell in some specimens unfortunately destroyed the P I, too.

_Juranomia calcibyssata_ FURSICH & WERNER 1989

**Post-larval shells**

The Polish specimens (only LVs) are 3-10 mm in diameter, nearly flat, and obliquely to symmetrically oval or round in outline. The umbo and beak are very small, pointed, and not terminal (Fig. 2A). Dorsal to the beak, the shell is always fused (Fig. 2B, also 3D). The ornamentation consists of fine radial threads generally covering the entire left valve although fading towards the ventral margin. At a distance of about six millimeters from the beak these threads are about 30 to 40 μm wide, the interspaces measure 80 to 110 μm. The threads have small pimples where they intersect the shallow growth steps. These swellings sometimes show initial stages of hyote scales (Fig. 2C). Under higher magnification, a second, irregular type of radial threads becomes visible next to the prodissocochn/dissoconch boundary. But these elements already disappear after 100 to 150 μm (Fig. 3A).

The internal face shows a broad, dark, calcitic outer zone and a lighter grey, aragonitic inner zone, which extends from the umbo to the central, depressed area of the shell (Fig. 2D). The central area bears the attachment scars of the main byssus retractor (largest), the smaller posterior byssus retractor, and the posterior adductor. The three scars are so close to each other that they appear to be imperfectly separated, however, well preserved specimens show that this is not the case (Fig. 2E). The anterior pedal retractor inserts anterior to the ligament groove. In addition, tiny pallial muscle bundles insert some distance from the central muscle field (Fig. 2D). The ligament pit is broadly triangular and largely hidden within the umbonal cavity (Fig. 2B).

The shell microstructure of the left valve apparently consists only of an outer foliaceous and an inner, cross-lamellar layer (Fig. 2D, F) (apart from the myostracum), that is, no outer prismatic or homogeneous layers were found. The aragonitic part is mainly of the branching cross-lamellar type (Fig. 2G, H) with subordinate patches of complex cross-lamellae. The total thickness of both layers is ca. 150 μm dorsal to the main byssus retractor, but the bulk of about 130 μm belongs to the aragonitic shell. The latter becomes reduced ventrally to around 80 μm. However, instead of wedging out, it is abruptly replaced by the outer foliaceous shell of ca. 100 μm thickness (Fig. 2I).