PTEROPOD ASSEMBLAGE IN THE MIOCENE
SEDIMENTS OF THE BAIA MARE REGION
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Abstract: The research for the present paper was carried out on material from S.C. "CUART" S.A. Baia Mare - Bâlie Dânești Well H9. The paleontological study emphasizes a pteropod assemblage. The species figured and described have not been cited in the literature on the Baia Mare region. Also, the age identification represents a novelty for our country. Four taxa are described and figured: Clio sinuosa (Bellardi, 1873); C. coebana Robba, 1972; C. braedensis (Bellardi, 1873); C. pullarrima (Mayer, 1868).

Key words: Early Miocene, Baia Mare, pteropods

The research on marine planktonic gastropods carried out in recent years has clearly verified that this group of mollusks represents an important biostratigraphic tool for the regional and interregional correlations of Cenozoic marine sediments.

Fig. 1 - Pteropods: 1 - Lucina (Spiralis), 2 - Cresets, 3 - Clio, 4 - Cavolinia, 5 - Vaginella, 6 - Cuvierina

There are two groups of planktonic gastropods which are preserved in fossil records: heteropods and pteropods. Heteropods are rather rare and recorded only from the Early Badenian. The pteropods of the Central Paratethys are represented by eight genera - Limacina (Spiralis), Cresets, Clio, Cavolinia, Vaginella, Cuverina, Styliola and Praephyloglyptis (Fig. 1) - which are distributed from the Middle Eocene to the Middle Miocene in this area.

The research for the present paper was carried out on material from Bâlie Dânești Well H9, the Baia Mare region (Fig. 2).

Fig. 2 - Geographical position of the studied area

The paleontological study of this material emphasizes a monogenic pteropod assemblage, with four species of the Clio genus which belongs to the Euthecosomata suborder, the Cavolinidae family. Pteropods are planktonic gastropods which belong to the Opistobranchiata subclass. The recent specimens of the Pteropoda order belong to two suborders: Euthecosomata (with two families - Spiratellidae (=Limactinidae) and Cavolinidae) and Pseudothecosomata (with three families - Peracidae, Cymbulidae and Desmopteridae).

Generally, the conch of Cavolinidae is calcified but thin, conic, with axial or bilateral symmetry, with a sharp apical end, straight or curved. The general shape is variable, conic, straight or curved, swollen out or flat, enlarged, coiled or uncoiled. The conch of Euclio genus (recent correspondent of the fossil genus Clio), of the Diacerita and Cavolinia genera seems to result from a "face to face" disposal of two "valves" more or less swollen out, equal or unequal, partially or completely united on the edges, beginning in the apical region. These "valves" often have an ornamentation of ribs and striae; their ribs or angles may continue laterally as sharpened tips (ex: Euclio cuspidata).

Research on recent Euthecosomata led to the idea that the "aberrant" form of their conch, except for the Spiratellidae, results from that of the Spiratellidae by an uncoiling and dorso-ventral flattening process, developing afterwards to different directions (Boas 1886, in Grasse 1968).

An unrolling process of a Spiratella conch, with a flat whorl, allows us to imagine a strait conch, with a downward apical end. Consequently, the pallial cavity, from dorsal, became ventral, so that the apical curve is directed upwards, as we can see in the Euclio and Cavolinia genera and less evident in Cresets genus. A dorso-ventral flattening appears in certain species of Euclio: E. antarctica, E. chapatti. Unequal growing of the ventral and dorsal surfaces, a thickening of the lateral side and the appearance of a median rib, confer to other Euclio species characteristic features: E. pyramidata, E. cuspidata. The aperture becomes a slot (Fig. 3). The conch is translucent or may present a slight colour. The operculum is thin, glassy, transparent, with an opposite winding as compared

Fig. 3 - The shell shape transformation of Euthecosomata left view sl - swimming lobe, pc - pallial cavity, f - foot (from Grasse, 1968)
to the shell's one. It is attached by a little part of its surface to the ventral lobe of the foot (=metapodium).

*Euthecosomata* have a transparent body. The foot is much widened laterally. The ventral foot is made of a median, thin lobe and two lateral ones which unite above the mouth and prolonged themselves into two swimming lobes.

The abdomen (Fig. 4) is twisted 180 degrees regarding the anterior part and, consequently, the pallial cavity becomes ventral.

**Fig. 4 - Euclio cuspidata, ventral side (after Meisenheimer, in Grasse 1968)**

We can find, as fossils, mostly the initial part of the conch (nepiococonch and more or less the protoconch) and seldom the last whorl or the entire teleoconch which, in most cases appears as internal or external casts. We consider it useful to present the terminology and the measurements accomplished which are illustrated in Fig. 5.

**Fig. 5 - Terminology used for the Clio genus**

We can observe 36 pteropods, all of them being species of the same genus, *Clio*. We described and figured four species: *Clio sinuosa* (Bellardi), *C. coebana* Robba, *C. braidensis* (Bellardi) and *C. pulcherrima* (Mayer).

**Phylum MOLLUSCA**

Class GASTROPODA Cuvier, 1787

Subclass OPISTHOBANCHIA

Order THECOSOMATA

Suborder EUTHECOSOMATA

Superfamily SPIRACELLACEA

Family CAVOLINIIDAE

**Clio sinuosa** (Bellardi) 1873

Pl. I, Fig. 1, 2; Pl. II, Fig. 1

1873 *Balantium sinuosum* Bellardi, Bellardi, p. 62, tav. 3, fig. 11

1977 *Clio sinuosa* (Bellardi), Robba, p. 503, tav. 22, fig. 5, tav. 23, fig. 1-2

The material is represented by only a conch, preserved as an internal mould cast of the dorsal side.

**Description:** Fan-shaped conch, slightly longer than wide. Lateral brims are slightly concave in the passage zone between the nepiococonch and the rest of the teleococonch, and slightly convex all along the rest of their length. Wide, arched aperture, bordered by lips with abapical convexity. The dorsal surface is convex; 3/5 of its width is occupied by a median, longitudinal prominence which just behind the nepiococonch is divided all along its length by two ditches which give rise to three subequal, rounded folds. The lateral zones are flat, triangular, slightly inclined towards the lateral brims.

The whole surface presents colabral, well marked, regular ribs, separated by shallow striales.

**Observations:** Our specimen is similar to the one figured and described by Robba, 1977.

**Age:** Eggerian (Late Chattian - Aquitanian)

**Provenience:** Bâile Dânești Well, Baia Mare.

**Distribution:** Italy, Miocene (Serrav, Tort) L.P.P. 321

**Clio coebana** Robba, 1972

Pl. I, Fig. 3, 4; Pl. II, Fig. 2

1972 *Clio coebana* sp. n., Robba, p. 499, tav. 59, fig. 8 - 10, tav. 60, fig. 1 - 4.

Our material is represented by three specimens, preserved as internal moulds and external casts.

**Description:** Subtriangular conch, slightly longer than wide, with a very sharp apex, straight, slightly curved towards the dorsal face. Lateral brims are acute, convex and more curved adapically. The arched apertural lip has an abapically convexity in the median zone. The dorsal face is occupied on 2/3 of its width by a median, longitudinal prominence which, just behind the apex, is divided all along its length by two shallow ditches which give rise to three rounded, rather depressional folds. The middle one is twice
wider than the other two. Marginal subtriangular areas gradually narrowing towards the apex, more widened ventrally, present a rather narrow fold which attenuates abapically. All over the surface, colobral ribs, more or less regular, are preserved.

**Observations:** Our specimen is similar to the one figured and described by Robba, 1972.

**Age:** Eggerian (Late Chattian - Aquitanian)

**Provenience:** Bâile Dănești Well, Baia Mare region

**Distribution:** Italy: Late Oligocene - Early Aquitanian

### Clio braudensis (Bellardi, 1873)

**Pl. I, Fig. 5, 6; Pl. II, Fig. 3**

1873 *Balantium braudensis* Bellardi, p. 62, tav. 3, fig. 12

1977 *Clio braudensis* (Bellardi), Robba, p. 594, tav. 19, fig. 6, tav. 20, fig. 2, 3

Our material is represented by five specimens, preserved as internal moulds and external casts of the dorsal surface.

**Description:** Fan-shaped conch, slightly longer than wide. Lateral brims slightly convex and divergent become concave abapically. Narrow marginal zones. Wide, arched aperture, bordered by convex lips with a pronounced abapical convexity. Dorsal surface convex, occupied on 2/5 of its width by a median, longitudinal prominence which, just behind the nepioconch is divided along its length by two narrow, superficial ditches which give rise to three rounded, slightly depressed folds. The lateral zones are not preserved. The dorsal area is covered with colobral ribs which attenuate on the median prominence.

**Observations:** Their state of preservation does not allow a precise attribution of our material to this species. However, all the five specimens highly resemble those figured by Robba, p. 628, tav. 20, fig. 3, 1977.

**Age:** Eggerian (Late Chattian - Aquitanian)

**Provenience:** Bâile Dănești Well, Baia Mare region

**Distribution:** Italy, Middle Miocene, Pliocene

### Clio pulcherrima (Mayer, 1868)

**Pl. I, Fig. 7, 8; Pl II, Fig. 4**

1873 *Balantium pulcherrimum* Bellardi, p. 63, tav. 3, fig. 13

1971 *Clio pulcherrima* Robba, p. 85, tav. 3, fig. 10 - 11

1977 *Clio pulcherrima* Robba, p. 597, tav. 22, fig. 1

Our material consists of about 27 specimens preserved as internal moulds or external casts of the dorsal area.

**Description:** Fan-shaped conch, almost twice longer than wide. Conical, straight nepioconch, with a length representing about 1/5 of the total length of the conch. Lateral brims are concave in the passage between the nepioconch and the remaining conch, then slightly convex. Slightly arched aperture, bordered by lips with reduced abapically convexity; the dorsal lip is subangular in the median zone. The dorsal surface is convex. Five divergent ditches appear just behind the nepioconch, giving rise to seven folds. The ditches attenuate in the apertural zone. The middle fold is the best marked. The whole area is covered with colobral, regular, numerous ribs, which are continuous on the folds and less marked on the lateral zones.

**Observations:** Our material shows a great number of common features with the material figured and described by Robba (1971, 1977).

Unfortunately, the available material does not allow the separation of more species. The reduced size and the extreme fragility of the conch may account for the appearance of internal moulds and external casts in sediments. Frequently, those casts are deformed because of either the conservation process or the plasticity of the sediment, situations which make the specific determination difficult. Also, because of the fossilization conditions, the conches are usually compressed dorso-ventrally, so we cannot reconstruct the transverse profile. As a result of the same compression or breaking process, transversal ribs may appear on the surface of the conch.

The research on recent pteropods reveals the fact that they swarm in the ocean in vast numbers. During storm gales pteropods are "pushed" to the shore zone where they are included in sediments as taphoceneses. Also, pteropods occur in tremendous abundance in some deep-sea sediments. In such a case they are covered by one another so that only the isolated conch can be studied more in detail.

Recent pteropods float during the day at depths between 100 and 400 meters, rising to the surface only after the sunset when the light is dimming or absent, a fact that indicates that pteropods are photophobic.

Displacement is made by movements of the swimming lobes, which are analogous to the movements of butterfly wings. Pteropods may float at the water surface or deeper, at a certain level, by a simple spreading of the swimming lobes; sinking is accomplished by gathering up. Such a manner of life makes these gastropods not significant as bathymetric indicators.

We know that most pteropods prefer temperate and tropical waters. However there are species like *Eucilio australis* which prefer boreal and austral temperate waters and even species of northern latitudes which represent the main food source for plankton-feeding whales.

Regarding water salinity we assume that the tolerable amount lies between 35% and 39%.
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Captions of Plates

PLATE 21. I

Figs. 1 - 2. Clio sinuosa (Bellardi), x 4. Early Miocene, Băile Dănești well, Baia Mare region, M. Velescu’s coll., LPP no. 321
Figs. 3 - 4. Clio coebana Robba, x 4. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 322
Figs. 5 - 6. Clio braidensis (Bellardi), x 4. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 323
Figs. 7 - 8. Clio pulcherrima (Mayer), x 4. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 324

PLATE 21. II

Fig. 1. Clio sinuosa (Bellardi), x 2,5. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 321
Fig. 2. Clio coebana Robba, x 2,5. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 322
Fig. 3. Clio braidensis (Bellardi), x 2,5. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 323
Fig. 4. Clio pulcherrima (Mayer), x 2,5. Early Miocene, Băile Dănești Well, Baia Mare region, M. Velescu’s coll., LPP no. 324
Figs. 5 - 6 Pteropods assemblage