UPPER BADENIAN BIVALVES IN THE CERNAVODA AREA

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Abstract. Based on investigations performed for the elaboration of geological sheet Cernavoda, scale 1:50,000, this paper presents Upper Badenian bivalve fauna in the Seimeni Formation. Fauna found in Upper Badenian limestones consists of bivalve, scaphopod, gastropod, polychaete, bryozoan, ostracod and foraminifer species and is indicative of shallow marine environment. The bivalves belong to three orders (Arcoida, Pterioida and Veneroida), 7 families, 17 genera and 40 species. Upper Badenian oysters in Cernavoda area are reviewed and new generic assignments suggested. Cubitostrea opisthogyrata new species is described in this paper.

Keywords: Upper Badenian, South Dobrogea, bivalves, new species.

INTRODUCTION

The occurrence of Miocene deposits near Seimenii Mari was first described by Toulou (1904) who mentioned in this site the Pecten Limestones.

Lithofacies, biofacies and the geological age of the fosiliferous Badenian deposits from Cernavoda area (see Cernavoda Sheet scale 1:50 000) have been commented by several authors: Macovei (1915), Athanasia (1915), Macovei & Atanasu (1937), Chiiriac (1960, 1970), Rado & Pana (1975), Iones & Chintauan (1978), Saraim (1986), Avram et al. (1996 a,b), Munteanu & Munteanu (1996), Munteanu (1996 - 1997).

STRATIGRAPHY AND DEPOSISIONAL ENVIRONMENT

In the studied area, the Neogene deposits (which unconformably overlie the Upper Aftian – Albian ones) are represented by Upper Badenian and Upper Basarabian deposits. They are outcropping in few places: Dunarea locality (Bacasic valley), Seimenii Mari and Seimenii Mici (right bank of the Danube and the Silistea valley) as well as the surroundings of Tortomane locality (Fig. 1 A).

In South Dobrogea (Fig. 1 A), the Upper Badenian deposits are represented mainly by biocalcarenites (Seimenii Formation, designated by Andreescu, in Ghenea et al., 1984 a, b). However, it observes a variety of lithofacies west–eastward. Thus, in Caranuara Fetei – Valeni region (Fig. 1 A a, A B a) sands, calcareous sandstones, conglomerates and biocalcareites are occurring (Chiiriac, 1960, 1970; Iones & Iones, 1973; Nicorci & Iones, 1992). In the Cernavoda area, soft limestones, containing siliclastic material, are characterised by the presence of fairly oyster fauna (Fig. 1 A a, B b). Their thickness varies between 0.8 and 2 m. In the northeastern part of South Dobrogea (Ghenea et al., 1984 a; Avram et al., 1996) and in the Black Sea Romanian shelf of South – Dobrogean type, the marls prevail (Catuneanu, 1991; Iones, 1994) (Fig. 1 A d, e).

In South Dobrogea, the depositional system of Upper Badenian deposits can be interpreted as a homoclinal ramp. Boring bivalves, tube secreting worms, encrusting bryozoan, existent in investigated area (Pl. V, Fig. 5, 7) are the common organisms on Neogene carbonate ramp (Buxton & Pedley, 1989, fide Einsele, 1992).

The fauna identified on the inner ramp consists of bivalve, scaphopod, gastropod, polychaete, bryozoan, ostracod and foraminifer species (Fig. 1 B a, b, c). Numerically, bivalves are the most important group and have been constantly mentioned in literature, but rarely illustrated (Munteanu, 1996 - 1997).

In contrast, molluscs are missing on the middle carbonate ramp (Fig. 1 B d). Finally, in the deep carbonate ramp (Fig. 1 B e), the high dominance of a single genus of gastropods (Limacina = "Spiralis"; Iones, 1994) indicates a less hospitable environment than inner ramp.

THE BIVALVE ASSEMBLAGE

Well preserved oysters and pectinids are prevailing in Seimenii Formation. They could be transported but not for a long distance, which is indicated by the fact that they are mostly undamaged and frequently encrusted with polychaetes of the genus Serpula or with bryozoans. The other groups (Anadara, Pilar, Cardites, Circumphragma, Corbula, Ertilia, Lopites etc.) are preserved as castings.

The order Arcidae is represented by subfamily Anadariinae (Fig. 2). Species of Anadara genus persist to endobystate suspension – feeders association.

The order Pterioidea is represented by two suborders: Pterinida and Ostreina. Among the Pterinida, the superfamly Pectinacea is represented by family Pectinidae: Chlamys genus is known by an abundant shells of Chlamys vamensis TOULA, 1892 (Pl. I, Figs. 2 - 4) beside which other three species have been identified. Number of riblets - three at Chlamys macrolis (SOWERBY), 1839 and five at Ch. angelonii spinosovatus (SACC), 1897 - on the rounded ribs are the major criteria for species discrimination (Pl. I, Figs. 6 - 11).

There were also identified two genera (Pododesmus and Anomia) pertaining to the family Anomiidae. Species of the first genus have smooth external surface, with very fine concentric lines; no adductor scars have been observed on collected material.

Pl. I, Figs. 12 – 16). The species of Anomia genus are characterized by their sculptured surface with radial striae (Pl. I, Figs. 17, 18).

The most representative group belongs to suborder Ostreina, superfamily Ostreacea which pertain to cemented epifaunal suspension – feeders association. Two families are important: Gryphaeidae and Ostreidae (Fig. 2).

The subfamily Exogyrae, unknown in this area and rarely mentioned in Miocene deposits from our country (Hinculov in Iliescu et al., 1988), is represented by three genera (Fig. 2). Their presence is very important because Exogyra group is very rarely described from the post - Cretaceous deposits (Stenzel, 1971). We have	

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identified in oyster assemblage valves pertaining to Exogyra, Nanogryra and Amphidonte (Pl. II, Figs. 1 – 4). Ligamental area regularly spiralled and adductor muscle imprint orbicular are the significant features of this group.

To subfamily Ostreinae were assigned 21 species pertaining to genera: Crassostrea, Saccostrea, Stryostrea, Ostrea, Cubitostrea and Flemingostrea.

The Crassostrea genus is represented by four species: Crassostrea cassiniana (LAMARCK), 1819, C. gryphoides (SCHLOTHEIM), 1813, C. gryphoides (SCHLOTHEIM), 1813, C. angusta (DESHAYES), 1864, among which C. gryphoides is the most frequent species. They are remarkable by very high outline, with subparallel anterior and posterior margins (Pl. II, Figs. 5 – 9). C. cassiniana tends to reach larger sizes with corresponding thickness (to 20 cm high). C. gryphoides has a small, pointed, opisthogyral to nearly orthogryal beak (Pl. II, Figs. 7, 8). Previously, they were mentioned in the region (excepting Crassostrea cassiniana), sometimes being assigned to other genera: Ostrea (Macovei, 1915; Ionesi & Chintauan, 1976), Gryphaea (Saraiman, 1986).

One species of Saccostrea genus - Saccostrea cusculeata (BORN), 1778 - has been identified in oyster association for the first time by Munteanu & Munteanu (1996). Our specimens are characterized by their spatulate form, very deep umbonal cavity and presence of chomata (Pl. II, Fig. 10). This genus is known from the Miocene to the Recent (Stenzel, 1971).

To Stryostrea genus was assigned one species: S. margaritacea (LAMARCK), 1819, mentioned (Stenzel,
1971) from the Eocene (North America) and from the Recent (South Africa, Central America). This species is presented and illustrated for the first time from the Badenian of Romania having distinguished features: very high ligamental area, adductor muscle imprint with concave dorsal margin and small well-rounded horns as well ornament of the left valve (Pl. III, Fig. 1).

The two known subgenera (Ostrea and Turkoostrea) of Ostrea genus have been identified (Pl. III, Figs. 2 - 6). Ostrea (Ostrea) lamellosa BROCCI, 1814 and O. (O.) oblayei DESHAYES, 1832 were described and illustrated in literature but never illustrated from this area. The two species have been reported from the Miocene of our country (Moisescu, 1955; Iliescu et al., 1968; Nicorici & Sagatovici, 1973; Ionesi & Lungu, 1978; Chira & Popa, 1996). Only right valves of the Turkoostrea subgenus have been identified; relict anachomata of several preceding growth stages are visible.

The specimens of Cubitostrea genus from the Cernavoda area have been described in two previous papers: the first (Munteanu, 1996 – 1997), who described and illustrated the following species (Pl. V, Figs. 1 – 8): Cubitostrea digitalina (DUBOIS), 1831, C. frondosa (DE SERRES), 1829, C. adriatica (LAMARK), 1819, C. cf. granensis (FANTANNES), 1880, C. caudata MÜNTER in GOLDFUSS, 1834, C. liniibrata crassa (SCHAFFER), 1910, and the second (Munteanu & Munteanu, in press), who described a new species (Pl. III, Fig. 7), C. semenienisi MUNTEANU & MUNTEANU.

Furthermore, in this paper is illustrated one species of Cubitostrea (Pl. VI, Fig. 1) which is similar as to features of left valve with the Eocene species C. plicata (SOLANDER in BRANDER), 1766.

A new species of Cubitostrea genus is described in this paper.
Family Ostridae RAFINESQUE, 1815
Subfamily Ostrinae RAFINESQUE, 1815
Genus Cubitostrea SACCO, 1897
Cubitostrea opisthogyrata E. MUNTEANU n. sp.
(PI. IV, Figs. 1-7)
Holotype - PI. IV, Fig. 1, Geologic Institute of
Romania Repository, no. IGP 196995.
Locus typicus - Seimenii Mari village, bank of the
Danube.
Stratum typicum - Upper Badenian, biogenic
limestones.
Derivatio nominis - From opisthogyral curved
ligamental area of left valve.
Material - Seimenii Mari village, bank of the Danube,
6 left valves (PI. IV, Figs. 1, 2, 4, 6, 7); Sliestea valley, 2
left valves (PI. IV, Figs. 3, 5); Boasvig valley (Dunarea
locality), 2 left valves.
Diagnosis - Small to medium sized, oval to orbiculate
in outline, slightly convex, 10-30 radial ribs; chomata
present; adductor imprint comma - shaped; umbonal
part is opisthogyral arched, but never twisted.
Description. - Small to medium sized (largest high of
left valve up to 11 cm). Left valve with convex anterior
margin and slightly convex posterior one. Outline
commonly oval - orbiculate tending to crescentic shapes.
Height/length ratio is bigger than 1.
External surface of the left valve is sculptured with
concenctric growth squamae and with 10 - 30 rounded
radial ribs, which include hyote spines which project
beyond valve periphery. Margin of left valve is
carinated.
Adductor muscle imprint comma - shaped is located
approximately halfway between hinge to branchiellum.
Chomata (to 15 mm) is present on each side of hinge.
Ligamental area is longer than high and is spiral in an
exogyroidal fashion. Anterior bourrelet is bigger than the
posterior one.
Dimensions - (in mm):

Height (H): between 19 - 110
Length (L): between 16 - 95.
Remarks - This new species differs of other species of
Cubitostrea in tendency of ligamental area to turn in
opisthogyral spiral fashion and in their outline tending to
orbicular shape.
Occurrence - South Dobrogea, Upper Badenian.
The Flemingostrea genus (reported from the
Cretaceous - Miocene interval) is represented by F.
heiligobosa (ROMANOVSKY), 1884 (PI. VI, Figs. 2, 3)
which on both has only both folds appearing later and
very gradually. Ligamental area is longer than high and
shoulders at ends of ligamental area have almost
rectangular shape. The Flemingostrea has not been
mentioned from the Miocene of our country.
Two species have been included in Allectyrella
(genus pertaining to subfamily Lopiphontae: A.
picatii (EMELIN), 1791, orbicular in outline, and A.
germanita (DE GREGORIO), 1884, oval in outline. These
species have the features of the genus: distance on posterior
side from hinge to branchiellum is very short, left valve
deep, attachment area very large, radial plications are
separated by interspaces of same size; adductor muscle
imprint higher than long, obliquely distorted with both
horns well rounded; chomata are present. Their
stratigraphic range is ?Milo, Plio - Recent (STENZEL,
1971). In our country was mentioned (like Ostraa picatii)
by Chira (1993) in Eggengburgen deposits.
Species of three genera of the order Veneroida
(subclass Heterodonta) have been illustrated (PL. VI,
Figs. 7-10). They are frequent in Miocene deposits.
The mentioned bivalve fauna belongs to the orders
(Arcoidea, Pterioida and Veneroida), 7 families, 17
genera and 40 species (out of which 2 are new). This
assemblage is similar with fauna of the other basins with
Upper Badenian deposits from Romania (BULGARI-
Moisescu, 1955; MEDIANA - ILIESCU et al., 1968; ZARAD -
NICOLICI & SAGATOVI, 1973; Moldavian Platform - LONESI
& Lungu, 1978) and from Ukraine (YANAKEVICH, 1985).
There is a strong similarity in the bivalve fauna
observed in this area with other regions from the Eastern
Paratethys with oyster fauna of Tarhanian -
Tchokrakian age (TURKEMENIA, CAUCASUS, CRIMEA-
MURATOV et al., 1986; BULGARIA - POPOV & KOUJMDJOV,
1987).
In the Central Paratethys, Miocene deposits
containing rich assemblages of oysters have been
assigned to the Lower Badenian and the Upper
Badenian (JAKUBOWSKI & MUSIAL, 1979).
In fact, the sands and conglomerates occurring in the
Valeni region were assigned by NICOLICI & LONESI (1992)
and the Badenian - Tchokrakian.

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REFERENCES
Atharasiu, S. 1915, Daculul la de la Formation
salifere de Roumanie. Inst. Geol. Rom., Comptes Rendus
Aram, E., Andreescu, I., Baltres, A., Ion. J., Mihaiescu, N.,
Munteanu, E., Munteanu, T., Oaie, G., Seghedi, A., Vaida,
M. 1998. Geological Map of Romania, scale 1:50,000,
Bucuresti.
Aram, E., Andreescu, I., Draganescu, A., Mihaiescu, N.,
Munteanu, T., Munteanu, E., Oaie, G., Seghedi, A., Szasz,
Rom., Bucuresti.
Aram, E., Neagu, Th. and Andreescu, I., Cretan. M.,
Munteanu, E., Pana, I., Pestrea, S., Popescu, Gh. 1996 b.
Stratigraphy of the Cretaceous, Paleogene and Neogene
deposits from South Dobrogea. Anuarul Institutului
6, 72 p., Bucuresti.

Born, I. von 1778, Index rerum naturalium musei Caesarei
Vindobonensis, Pars Kma, Testaceae. Verzeichnis der
natürlichen seltenheiten des K. K. Naturien Kabinetts zu
Wien, Erster Theil, Schallhierae, 486 p. Officina Krausiana,
Vienna.
Brander, G. 1766, Fossilia Hantoniensis collecta, et in Musaeo
Britannico deposita. v. 1, 43 p., London.
Brochi, G. B. 1814, Conchologia fossile subapennina con
osservazioni geologiche sulle specie e sulle sedi
adiacente. G. Silvestri, Stamperia Reale, v. 2, p. 241 - 712,
Milano.
Catuneanu, O. 1991, The geology of the Black Sea Romanian
Shelf of South-Dobrogean type. Analele Universitatii
Bucuresti, Geol., 40-41, p. 51-60, Bucuresti.
Chira, C. 1993, A Study of the Neogene Bivalves from the
Livada-Padureni-Agris-Comesati Area (Cluj County) by
Means of the Petrographic and Electronic Microscopes.
Studia Universitatis Babes - Bolyai, XXXVII, p. 61-65, Cluj
- Napocas.
PLATES

Plate I
Fig. 1 *Anadara diluvi* (LAMARCK), X 1, Seimenii Mari
Figs. 2-4 *Chlamys varnensis* (TOULA), X 1, Fig. 2 Seimenii Mari, Figs. 3, 4 Boasigic valley
Fig. 5 *Chlamys brussoni defranchi* (MICHIELOTTI), X 1, Seimenii Mari
Figs. 6-9 *Chlamys macrotis* (SOWERBY), Figs. 6 – 9 a X 1, Fig. 9 b X 8, Figs. 6, 9 Seimenii Mari, Figs. 7, 8 Silistea valley
Figs. 10-11 *Chlamys angeloni spinososcutatus* (SACCO), Figs. 10, 11 a X 1, Fig. 11 b X 8, Seimenii Mari
Figs. 12,13 *Pododesmus* (Heteranomia) *squamosus* (LINNE), X 1, Silistea valley
Fig. 14 *Pododesmus* (Heteranomia) *perigibbosus* (SACCO), X 1, Silistea valley
Fig. 15 *Pododesmus* (Heteranomia) *orbiculatus* (BRONN), X 1, Silistea valley
Fig. 16 *Pododesmus* (Heteranomia) *cylindricus* (GMELIN), X 1, Boasigic valley
Figs.17,18 *Anomia* (Anomia) *ephippium rugulosostriata* BRONN, X 1, Boasigic valley

Plate II
Figs. 1,2 *Exogyra* (Exogyra) sp., Fig. 1 left valve, X 1,2, Silistea valley; Fig. 2 right valve, X 0,9, Seimenii Mari
Fig. 3 *Nanogyra* sp., left valve, X 1, Seimenii Mari
Fig. 4 *Amphidonta* sp., left valve, X 1, Silistea valley
Fig. 5 *Crassostrea crassissima* (LAMARCK), left valve, X 0,5, Silistea valley
Fig. 6 *Crassostrea gingersis* (SCHLOTHEIM), both valves, X 0,75, Silistea valley
Figs.7,8 *Crassostrea gryphoides* (SCHLOTHEIM), X 0,5, Fig. 7 left valve, Seimenii Mari; Fig. 8 anterior view of left valve, Silistea valley
Fig. 9 *Crassostrea angusta* (DESHAYES), left valve, X 0,75, Boasigic valley
Fig. 10 *Saccostrea cucculata* (BORN), left valve, X 1, Seimenii Mari

Plate III
Fig. 1 *Stryrostrea margaritacea* (LAMARCK), left valve, X 0,75, Boasigic valley
Figs. 2,3 *Ostrea* (Ostrea) *lamellosa* BROCHI, Fig. 2 left valve, X 0,5, Fig. 3 right valve, X 0,75, Seimenii Mari
Fig. 4 *Ostrea* (Ostrea) *boleyaei* DESHAYES, left valve, X 0,5, Silistea valley
Fig. 5 *Ostrea* (Ostrea) *cymbula* LAMARCK, left valve, X 0,75, Silistea valley
Fig. 6 *Ostrea* (Turkostrea) sp., right valve, X 0,75, Seimenii Mari
Fig. 7 *Cubitoostrea seimeniensis* MUNTEANU & MUNTEANU, left valve, X 1, Seimenii Mari

Plate IV
Figs. 1-7 *Cubitoostrea opisthogyrate* n.sp., Fig. 1 holotype, left valve, X 0,5, Seimenii Mari, IGP 19695.
Figs. 2,4,5,7 left valves, Seimenii Mari; Figs. 3,5 left valves, Silistea valley; Fig. 2 X 0,75, Fig. 3 X 1,1, Figs. 4-7 X 1;
Figs. 1a – 7a external view, Figs. 1b – 7b, internal view
Figs. 8-10 *Cubitoostrea digitalina* (DUBOIS), Figs. 8, 9 left valves, Fig. 10 right valve, Figs. 8,10 X 1, Fig. 9 X 0,75,
Boasigic valley

Plate V
Figs. 1,2 *Cubitoostrea frondose* (DE SERRES), Fig. 1 left valve, Fig. 2 right valve, X 0,9, Seimenii Mari
Fig. 3 *Cubitoostrea subfimbriata* SACCO, left valve, X 1, Boasigic valley
Fig. 4 *Cubitoostrea adriatica* (LAMARCK), left valve, X 1, Silistea valley
Fig. 5 *Cubitoostrea cf. granensis* (FONTANNAES), left valve, X 1, Silistea valley
Fig. 6 *Cubitoostrea caudata* MUNSTER, left valve, X 1, Boasigic valley
Figs.7,8 *Cubitoostrea fimbriata crassa* (SCHAFER), left valves, Fig. 7 X 0,7, Fig. 8 X 1, Silistea valley

Plate VI
Fig. 1 *Cubitoostrea* sp., left valve, X 1, Silistea valley
Figs. 2,3 *Flamingostrea hemiglobosa* (ROMANOVSKIY), right valves, X 0,75, Fig. 2 Seimenii Mari, Fig. 3 Silistea valley
Fig. 4 *Allectryonella plicata* (GMELIN), left valve, X 1, Boasigic valley
Figs. 5,6 *Allectryonella germanata* (DE GREGORIO), left valves, X 0,75, Seimenii Mari
Fig. 7 *Cardites partchii* (GOLDFUS), X 1, Seimenii Mari
Fig. 8 *Circomphalus subplicatus* (D’ORBIGNY), X 1, Seimenii Mari
Fig. 9 *Pilar Islandicoides* (LAMARCK), X 1, Seimenii Mari
Fig. 10 *Pilar gigas* (LAMARCK), X 1, Silistea valley

All specimens: Upper Badenian, Cernavoda area.