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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 constists 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 Toula (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), Athanasiu (1915), Macovei & Atanasiu (1937), Chiriac (1960, 1970), Rado & Pana (1975), Ionesi & Chintauan (1976), Saraiman (1986), Avram et al. (1996 a,b), Munteanu & Munteanu (1996), Munteanu (1996 - 1997).

STRATIGRAPHY AND DEPOSITIONAL ENVIRONMENT

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

In South Dobrogea (Fig. 1 A), the Upper Badenian deposits are represented mainly by biocalcarenites (Seimeni Formation, designated by Andreescu, in Ghenea et al., 1984 a, b). However, it observes a variety of lithofacies west–eastward. Thus, in Canaraua Fetei – Valeni region (Fig. 1 A a, B a) sands, calcareous sandstones, conglomerates and biocalcarenites are occurring (Chiriac, 1960, 1970; Ionesi & Ionesi, 1973; Nicorici & Ionesi, 1992). In the Cernavoda area, soft limestones, containing siliciclastic material, are characterised by the presence of fairly oyster fauna (Fig. 1 A b, 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., 1998) and in the Black Sea Romanian shelf of South – Dobrogean type, the marls prevail (Catuneanu, 1991; Ionesi, 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 bryozoa, 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 constists 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 constantelly 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* = "*Spirialis*"; Ionesi, 1994) indicates a less hospitable environment than inner ramp.

THE BIVALVE ASSEMBLAGE

Well preserved oysters and pectinids are prevailing in Seimeni 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, Pitar, Cardites, Circomphalus, Corbula, Ervilia, Loripes* etc.) are preserved as castings.

The order *Arcoida* is represented by subfamily *Anadarinae* (Fig. 2). Species of *Anadara* genus pertain to endobyssate suspension – feeders association.

The order *Pterioida* is represented by two suborders: *Pteriina* and *Ostreina*. Among the *Pteriina*, the superfamily *Pectinacea* is represented by family *Pectinidae*: *Chlamys* genus is known by an abundant shells of *Chlamys varnensis* TOULA, 1892 (Pl. I, Figs. 2-4) beside which other three species have been identified. Number of riblets - three at *Chlamys macrotis* (SOWERBY), 1839 and five at *Ch. angelonii spinosovatus* (SACCO), 1897 - on the rounded ribs are the main 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 cemmented epifaunal suspension – feeders association. Two families are important: *Gryphaeidae* and *Ostreidae* (Fig. 2).

The subfamily *Exogyrinae*, unknown in this area and rarely mentioned in Miocene deposits from our country (Hinculov in Iliescu et al., 1968), 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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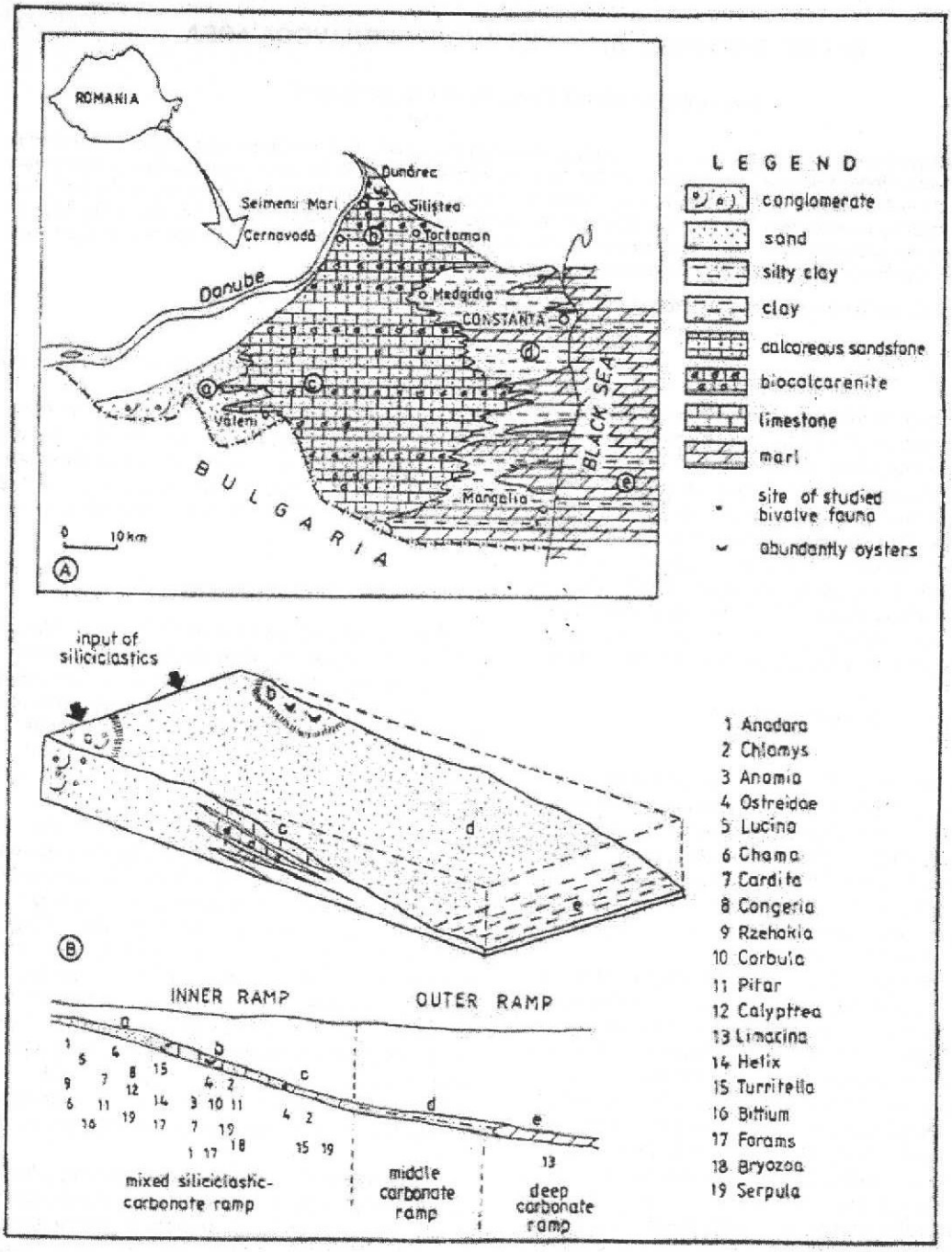

Figure 1 - Main lithofacies and faunal distribution on the Upper Badenian ramp of South Dobrogea

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

One species of *Saccostrea* genus - *Saccostrea cucculata* (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,

CLASS	SUBCLASS	ORDER	SUBORDER	SUPERFAMILY	FAMILY	SUBFAMILY	TAXA	
BIVALVIA	PTERIOMORPHIA	ARCOIDA		ARCACEA	ARCIDAE	ANADARINAE	*Anodara*	*diluvii* (Lamarck) *
		PTERIOIDA	PTERIINA	PECTINACEA	PECTINIDAE		*Chlamys*	*variensis* (Toula) * *brussoni delfrancei* (Michelotti) *macrotis* (Sowerby) *angelonii spinosovetus* (Sacco)
				ANOMIACEA	ANOMIIDAE		*Pododesmus (Heteranomia)*	*squamulus* (Linné) *pergibbosus* (Sacco) *orbiculatus* (Brann) *cylindricus* (Gmelin)
							Anomia (Anomia)	*ephippium* *rugulosostriata* Brann
			OSTREINA	OSTREACEA	GRYPHAEIDAE	EXOGYRINAE	*Exogyra*	*sp.*
							Nanogyra	*sp*
							Amphidonte	*sp*
					OSTREIDAE	OSTREINAE	*Crassostrea*	*crassissima* (Lamarck) *gingensis* (Schlotheim) * *gryphoides* (Schlotheim) * *angusta* (Deshayes) *
							Saccostrea	*cucullata* (Born)
							Stryostrea	*margaritacea* (Lamarck)
							Ostrea (Ostrea)	*lamellosa* Brocchi * *boblayei* Deshayes *cymbula* Lamarck
							(Turkostrea)	*sp.*
							Cubitostrea	*seimeniensis* Munt. & Munt *opisthogyrata* n. sp *digitalina* (Dubois) * *frondosa* (De Serres) *sublimriata* Sacco *adriatica* (Lamarck) * *cf. granensis* (Fontannes) * *caudata Münster* *limbriata crassa* (Schaffer) *sp.*
							Flemingostrea	*hemigiobosa* (Romanovsky)
						LOPHINAE	*Allectryonella*	*plicatula* (Gmelin) *germanitata* (De Gregorio)
	HETERODONTA	VENEROIDA		CARDITACEA	CARDITIDAE	CARDITESINAE	*Cardites*	*partschi* (Goldfuss)
				VENERACEA	VENERIDAE	VENERINAE	*Circomphalus*	*subplicatus* (d'Orbigny)
						PITARINAE	*Pitar*	*islandicoides* (Lamarck) * *gigas* (Lamarck)

Figure 2 - Bivalve fauna in Cernavoda area (* - previously mentioned species)

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 *Turkostrea*) of *Ostrea* genus have been identified (Pl. III, Figs. 2 - 6). *Ostrea (Ostrea) lamellosa* BROCCHI, 1814 and *O.(O) boblayei* 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 *Turkostrea* 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* (LAMARCK), 1819, *C. cf. granensis* (FONTANNES), 1880, *C. caudata* MÜNSTER in GOLDFUSS, 1834, *C. fimbriata crassa* (SCHAFFER), 1910, and the second (MUNTEANU & MUNTEANU, in press), who described a new species (Pl. III, Fig. 7), *C. seimeniensis* 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 Ostreidae RAFINESQUE, 1815
Subfamily Ostreinae RAFINESQUE, 1815
Genus Cubitostrea SACCO, 1897
Cubitostrea opisthogyrata E. MUNTEANU n. sp.
(Pl. IV, Figs. 1-7)

Holotype - Pl. IV, Fig. 1, Geological Institute of Romania Repository, no. IGP 19695.

Locus typicus.- Seimenii Mari village, bank of the Danube.

Stratum typicum - Upper Badenian, biogenic limestones.

Derivatio nominis - From opisthogyrally curved ligamental area of left valve.

Material. - Seimenii Mari village, bank of the Danube, 5 left valves (Pl. IV, Figs. 1, 2, 4, 6, 7); Silistea valley, 2 left valves (Pl. IV, Figs. 3, 5); Boasgic 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 opisthogyrally 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 – orbicular tending to crescentic shapes. Height/length ratio is bigger than 1.

External surface of the left valve is sculptured with concentric growth squamae and with 10 – 30 rounded radial ribs, which include hyote spines which project beyound valve periphery. Margin of left valve is carenated.

Adductor muscle imprint comma – shaped is located approximatelly halfway between hinge to branchitellum. 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. hemiglobosa* (ROMANOVSKIY), 1884 (Pl. VI, Figs. 2, 3) which has on both their valves 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 *Allectryonella* genus (pertaining to subfamily Lophinae): *A. plicatula* (GMELIN), 1791, orbicular in outline, and *A. germanitala* (DE GREGORIO), 1884, oval in outline. These species have the features of the genus: distance on posterior side from hinge to branchitellum 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, obliquelly distorted with both horns well rounded; chomata are present. Their stratigrafic range is ?Mio., Plio. – Recent (Stenzel, 1971). In our country was mentioned (like "*Ostrea*" *plicatula*) by Chira (1993) in Eggenburgian 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 three orders (*Arcoida, 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 (Buituri – Moisescu, 1955; Mehadia – Iliescu et al., 1968; Zarand – Nicorici & Sagatovici, 1973; Moldavian Platform – Ionesi & Lungu, 1978) and from Ukraina (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 – Tschokrakian age (Turkmenia, Caucasus, Crimea – Muratov et al., 1986; Bulgaria – Popov & Kojumdgieva, 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 occuring in the Valeni region were assigned by Nicorici & Ionesi (1992) to the Badenian – Tschokrakian.

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PLATES

Plate I

Fig. 1 *Anadara diluvii* (LAMARCK), X 1, Seimenii Mari
Figs. 2-4 *Chlamys varnensis* (TOULA), X 1, Fig. 2 Seimenii Mari, Figs. 3, 4 Boasgic valley
Fig. 5 *Chlamys brussoni defrancei* (MICHELOTTI), 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 angelonii spinosovatus* (SACCO), Figs. 10, 11 a X 1,Fig. 11 b X 8, Seimenii Mari
Figs. 12,13 *Pododesmus (Heteranomia) squamulus* (LINNE), X 1, Silistea valley
Fig. 14 *Pododesmus (Heteranomia) pergibbosus* (SACCO), X 1, Silistea valley
Fig. 15 *Pododesmus (Heteranomia) orbiculatus* (BRONN), X 1, Silistea valley
Fig. 16 *Pododesmus (Heteranomia) cylindricus* (GMELIN), X 1, Boasgic valley
Figs.17,18 *Anomia (Anomia) ephippium rugulosostriata* BRONN, X 1, Boasgic 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 *Amphidonte* sp., left valve, X 1, Silistea valley
Fig. 5 *Crassostrea crassissima* (LAMARCK), left valve, X 0,5, Silistea valley
Fig. 6 *Crassostrea gingensis* (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, Boasgic valley
Fig. 10 *Saccostrea cucculata* (BORN), left valve, X 1, Seimenii Mari

Plate III

Fig. 1 *Stryostrea margaritacea* (LAMARCK), left valve, X 0,75, Boasgic valley
Figs. 2,3 *Ostrea (Ostrea) lamellosa* BROCCHI, Fig. 2 left valve, X 0,5, Fig. 3 right valve, X 0,75, Seimenii Mari
Fig. 4 *Ostrea (Ostrea) boblayei* 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 *Cubitostrea seimeniensis* MUNTEANU & MUNTEANU, left valve, X 1, Seimenii Mari

Plate IV

Figs. 1-7 *Cubitostrea opisthogyrata* n.sp., Fig. 1 holotype, left valve, X 0,5, Seimenii Mari, IGP 19695. Figs. 2,4,6,7 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 *Cubitostrea digitalina* (DUBOIS), Figs. 8, 9 left valves, Fig. 10 right valve, Figs. 8,10 X 1, Fig. 9 X 0,75, Boasgic valley

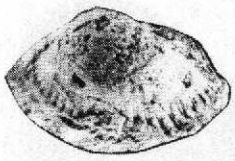
Plate V

Figs. 1,2 *Cubitostrea frondosa* (DE SERRES), Fig. 1 left valve, Fig. 2 right valve, X 0,9, Seimenii Mari
Fig. 3 *Cubitostrea subfimbriata* SACCO, left valve, X 1, Boasgic valley
Fig. 4 *Cubitostrea adriatica* (LAMARCK), left valve, X 1, Silistea valley
Fig. 5 *Cubitostrea* cf. *granensis* (FONTANNES), left valve, X 1, Silistea valley
Fig. 6 *Cubitostrea caudata* MUNSTER, left valve, X 1, Boasgic valley
Figs.7,8 *Cubitostrea fimbriata crassa* (SCHAFFER), left valves, Fig. 7 X 0,7, Fig. 8 X 1, Silistea valley

Plate VI

Fig. 1 *Cubitostrea* sp., left valve, X 1, Silistea valley
Figs. 2,3 *Flemingostrea hemiglobosa* (ROMANOVSKIY), right valves, X 0,75, Fig. 2 Seimenii Mari, Fig. 3 Silistea valley
Fig. 4 *Allectryonella plicatula* (GMELIN), left valve, X 1, Boasgic valley
Figs. 5,6 *Allectryonella germanitala* (DE GREGORIO), left valves, X 0,75, Seimenii Mari
Fig. 7 *Cardites partschi* (GOLDFUS), X 1, Seimenii Mari
Fig. 8 *Circomphalus subplicatus* (D'ORBIGNY), X 1, Seimenii Mari
Fig. 9 *Pitar islandicoides* (LAMARCK), X 1, Seimenii Mari
Fig. 10 *Pitar gigas* (LAMARCK), X 1, Silistea valley

All specimens: Upper Badenian, Cernavoda area.



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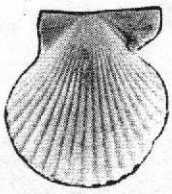

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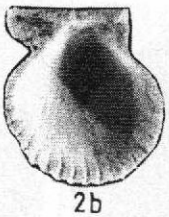

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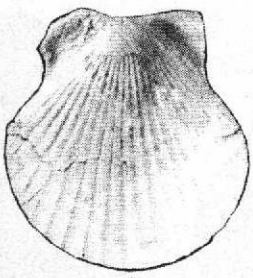

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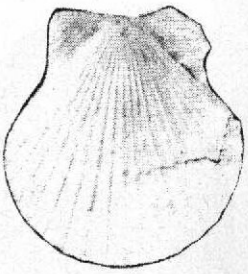

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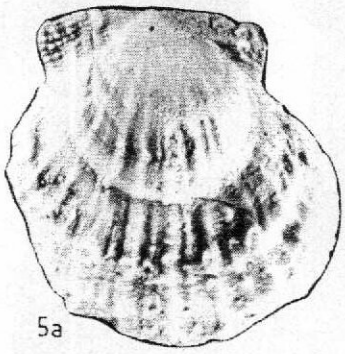

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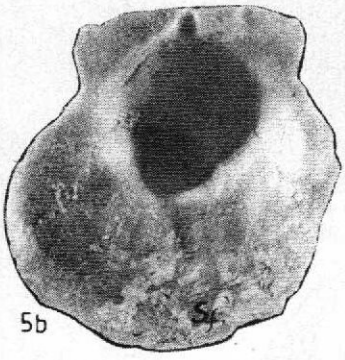

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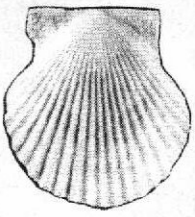

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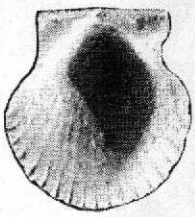

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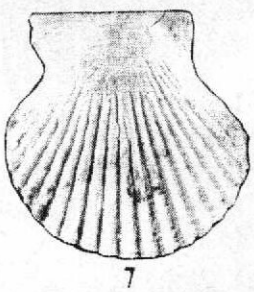

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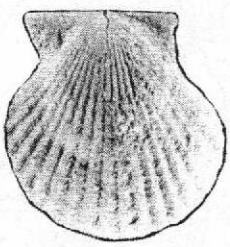

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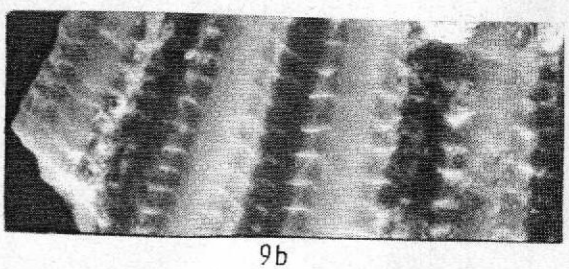

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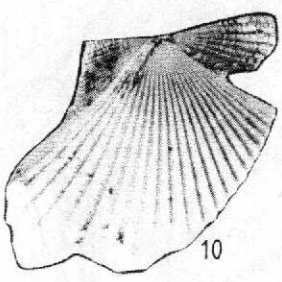

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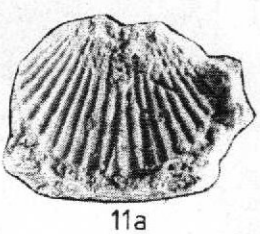

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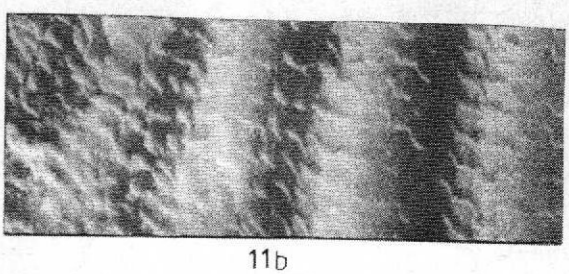

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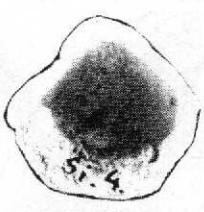

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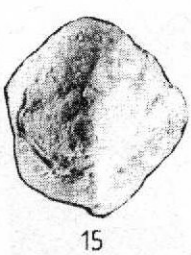

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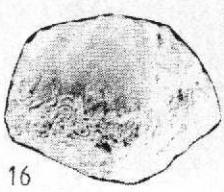

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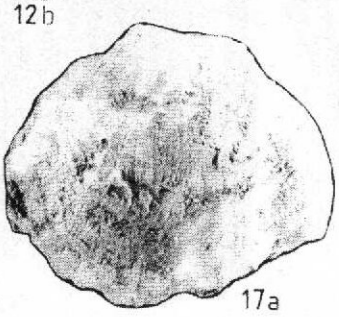

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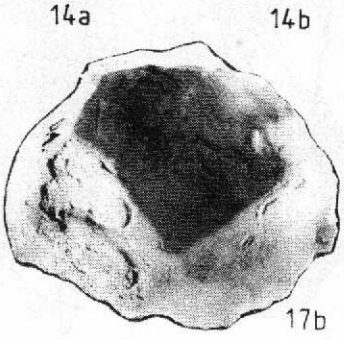

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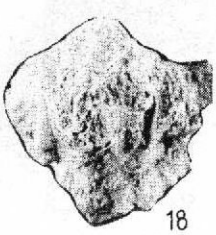

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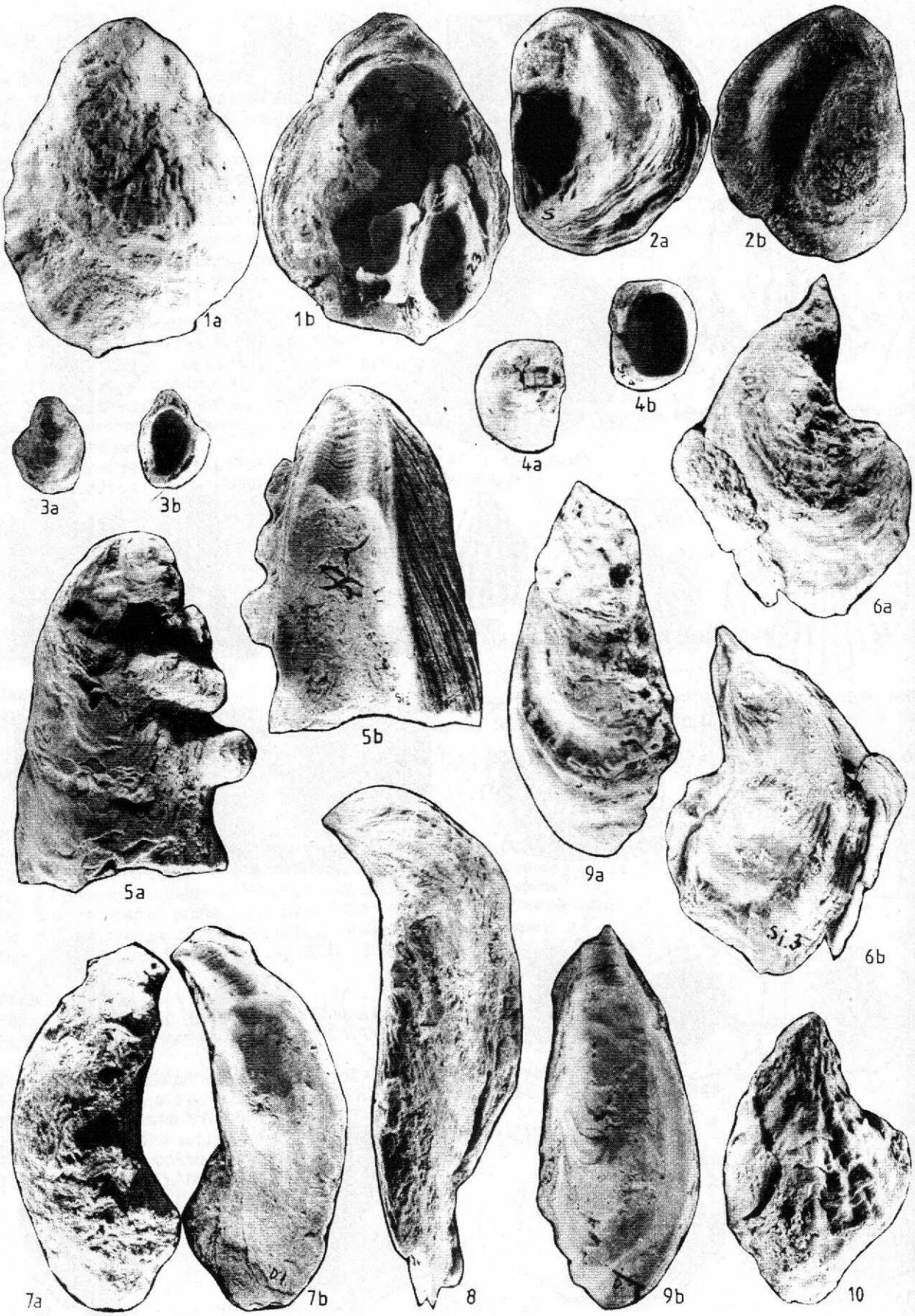
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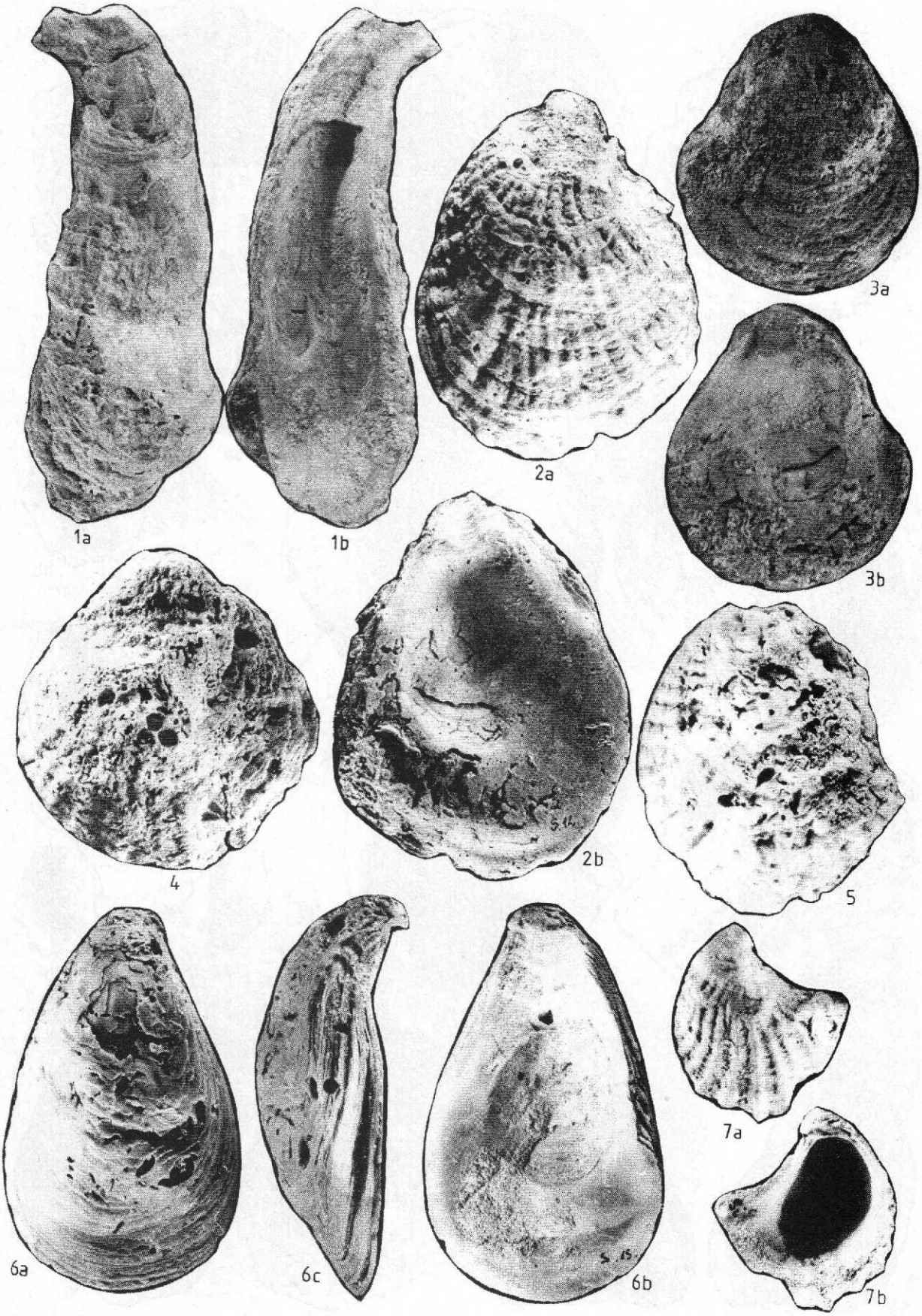
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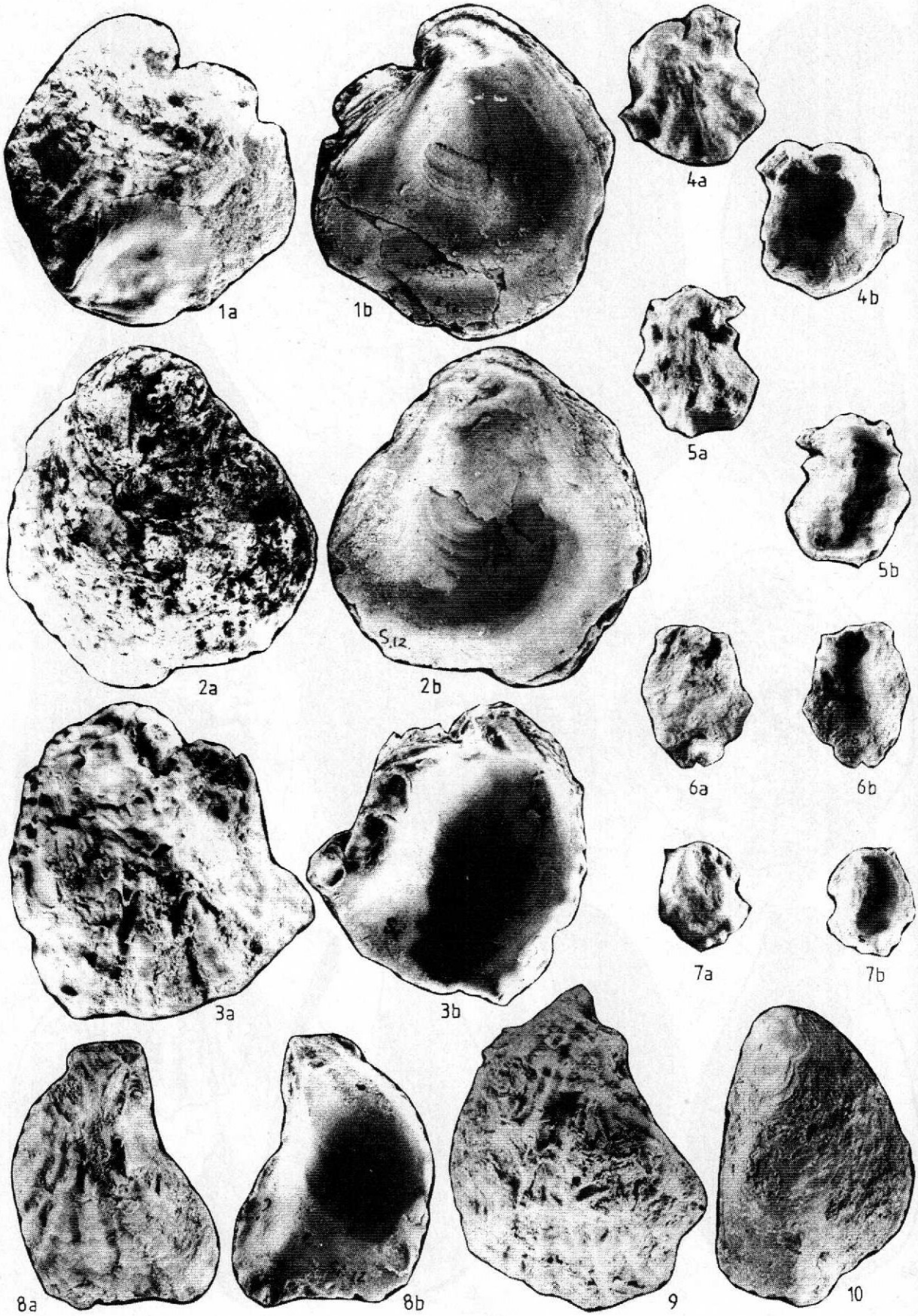
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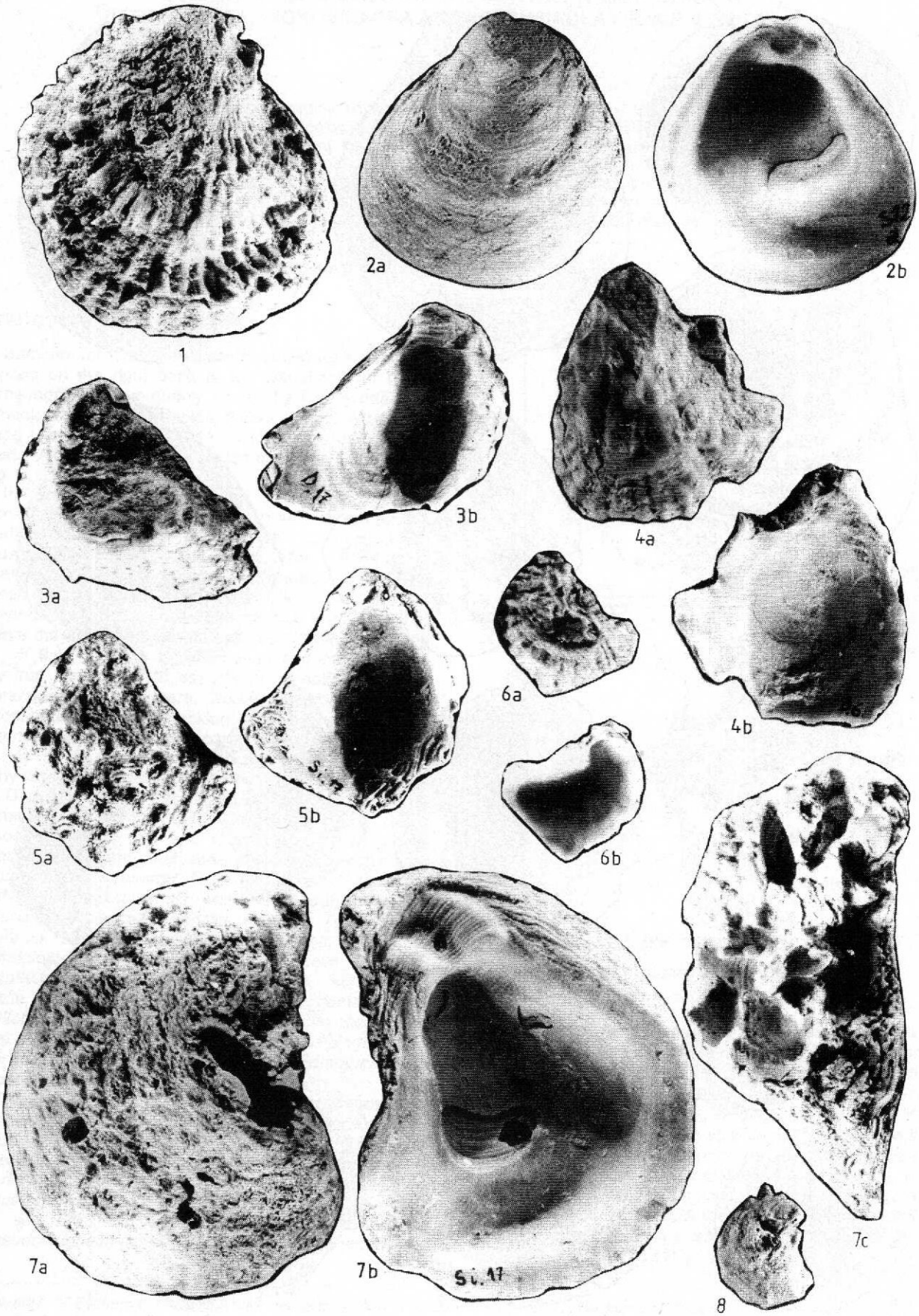
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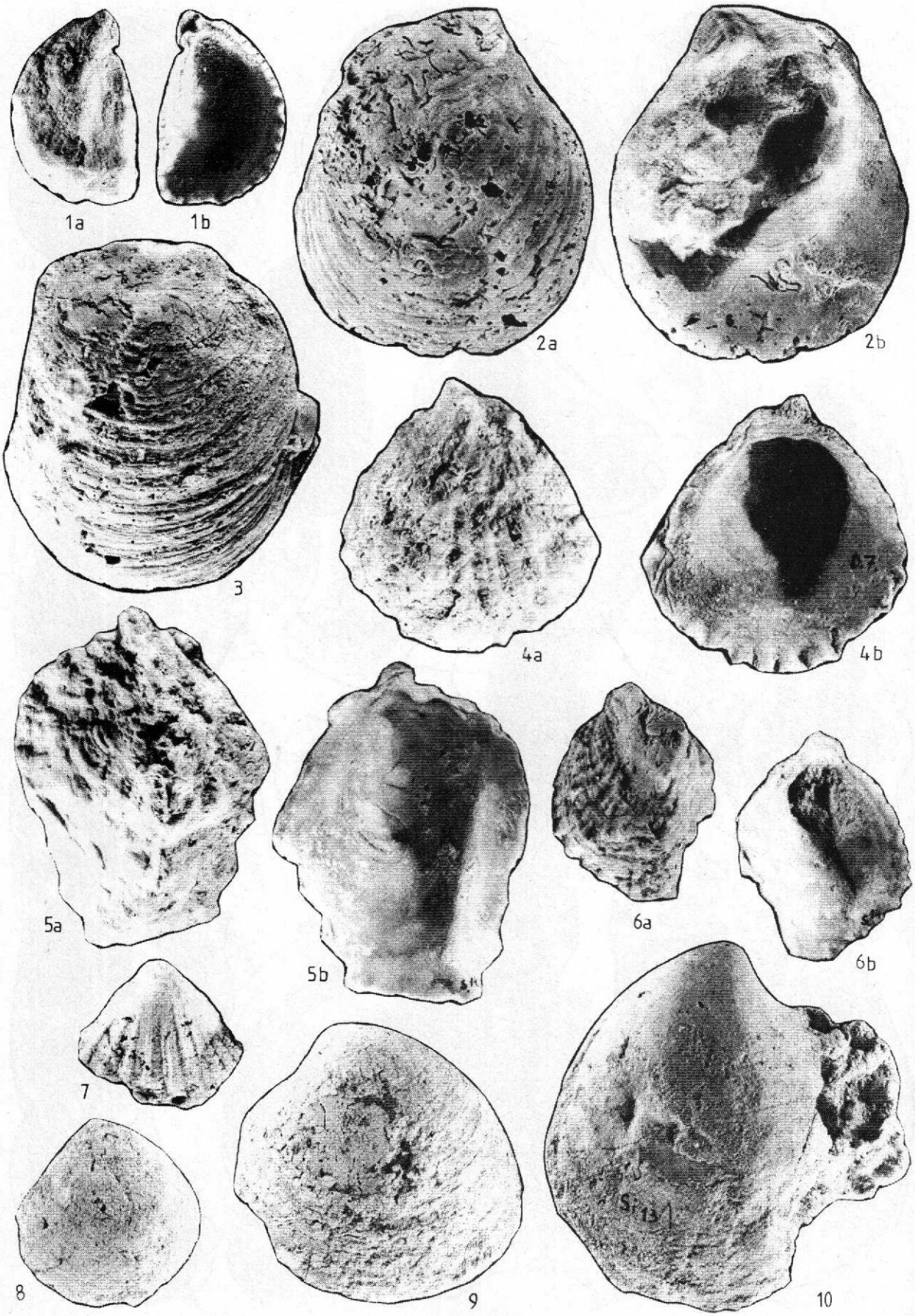
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