

THE STRATIGRAPHIC POSITION OF THE LATE CRETACEOUS INOCERAMIDS FROM THE OLĂNEȘTI – CHEIA BASIN (SOUTHERN CARPATHIANS)

Răsvan DAMIAN¹ and Iuliana LAZĂR²

Abstract: The Cheia and Olănești valleys are among the most representative areas with Upper Cretaceous siliciclastic deposits overlying the reef limestones of the Buila – Vânturarița Massif. These Upper Cretaceous siliciclastic deposits are represented mainly by successive sequences of conglomerates and marls, having been interpreted for very long time as the results of four important sedimentary cycles, which took place during the Cenomanian – Upper Senonian interval. According to the interpretation of Szasz (in Lupu *et al.*, 1978) of the geologic map of the Olănești – Cheia area, the recurrence of some of the Upper Cretaceous terms is the result of tectonically controlled distribution. The extensive field work accomplished during the last 15 years in this area resulted in numerous paleontological data that allow a better understanding of the lithostratigraphic evolution for this sector of the Olănești – Cheia sedimentary basin. In the Cheia and Olănești valleys outcrops yielding numerous inoceramids were identified. The collected fauna represents paleoecological niches with relatively large specific variability of the inoceramids; solitary specimens were also collected from different Upper Cretaceous outcrops, apart from the outcrops yielding the assemblages described herein. For the first time in the studied area, the present paper specifies the stratigraphic position of the inoceramids-bearing beds and figures some of the studied inoceramids taxa.

Keywords: Inoceramids, Upper Cretaceous, Cheia Valley, Olănești Valley, South Carpathians, Romania.

INTRODUCTION

The Upper Cretaceous deposits, very well exposed in the Olănești – Cheia basin, are lying unconformably (paraconformity) on the top of Upper Jurassic/Lower Cretaceous deposits (reef limestones) outcropping in the Buila – Vânturarița Massif. These deposits belong to the Getic Nappe (Median Dacides, South Carpathians) according to Săndulescu (1984).

The Upper Cretaceous deposits are represented by siliciclastic sequences of conglomerates, sandstones and marls, which were previously considered as representing four successive sedimentary cycles built up during the Cenomanian – Upper Senonian interval. Szasz (in Lupu *et al.*, 1978) had an original interpretation concerning the evolution of the studied area during the Upper Cretaceous times, graphically represented on the geological map. On this map, Szasz suggested that different terms of the Upper Cretaceous deposits are disposed in successive recurrence, due to the effect of some local tectonic events. The intensive fieldwork carried out in this area during the last 15 years and the observations made during the summer of 2005, led to the age recalibration of these deposits (based on fossil assemblages) and to a new interpretation of the evolution of the studied sector of the Olănești – Cheia sedimentary basin, during the Upper Turonian – Lower Maastrichtian interval. The inoceramid taxa support the existence at two time intervals: Upper Turonian – Lower Coniacian and Middle-Upper Coniacian – Lower Campanian.

A rich invertebrate macrofauna assemblage, represented by numerous inoceramids, echinoids and ammonites, was collected from the Olănești – Cheia Basin (Fig. 1). The collected fauna is considered as being representative for two different ecological niches, here named A and B. Other outcrops with isolated inoceramids cannot be used as to sustain the age of the Upper Cretaceous stages that we represented on the map (triangles on the Fig. 1).

The inoceramids show a large specific and generic diversity, being represented by a large number of individuals. The faunal assemblages from outcrops A and B were never described or figured in previous papers concerning the geology and the paleontology of the studied area.

Popescu-Voitești (1910, 1915) demonstrated for the first time the presence of Cretaceous deposits in the area, in the Căndoaia and Stogu Peak zones, near the confluence of the Olănești and Stoia valleys, in an area of forest exploitation. The mentioned author identified a rich fossil fauna with: *Micraster cortestudinarius* GOLDFUSS, *Avicula* sp., *Exogyra* sp., *Cucullaea (Arca)* cf. *rozana* d'ORBIGNY, *Inoceramus crispus* MANTELL, *Scaphites* sp., *Ammodiscus obscurus* SCHLITZER and coral fragments. Based on previous researches by Popescu (1952, 1954), Popescu & Patrulea (1968), Boldur *et al.* (1970) separated three sedimentary cycles in the Olănești-Cheia basin, considered as being Vraconian – Cenomanian – Turonian, Coniacian – Santonian and Campanian – Maastrichtian, respectively. Boldur *et al.* (1970) published the geological map

^{1, 2} University of Bucharest, Faculty of Geology and Geophysics, Laboratory of Palaeontology, 1, N. Balcescu Ave., RO-010041, Bucharest, ROMANIA; damianr@k.ro; iulia_lazar@k.ro

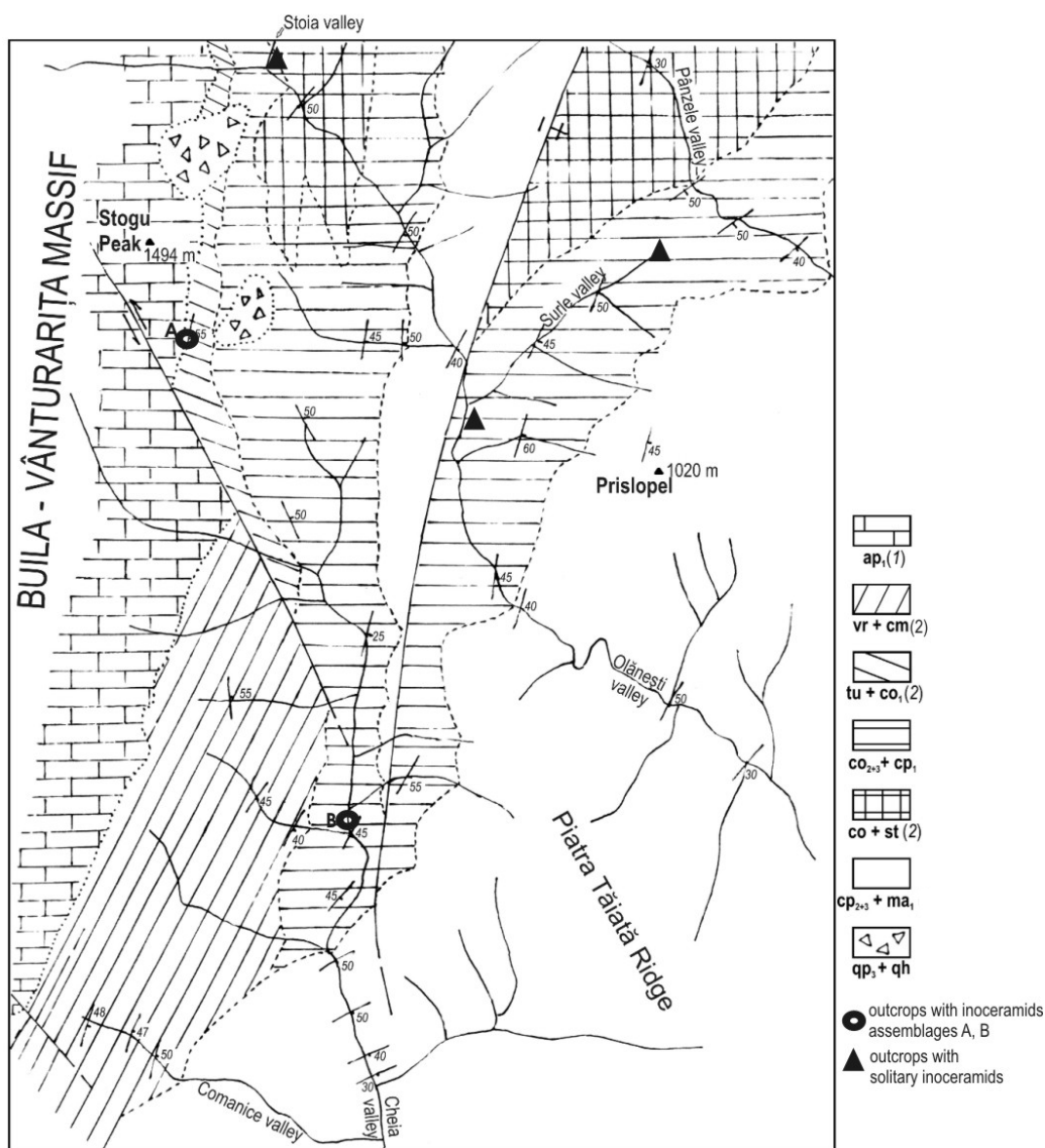


Figure 1. Sketch map with of the area situated on the eastern part of the Buila – Vânturarița Massif and the location of the sites with inoceramids (modified from Lupu *et al.*, 1978). The authors of the present paper modified some of the geologic and tectonic boundaries: (1) – Dragastan *et al.*, 2000; (2) – Lupu *et al.*, 1978.

of the area, based on the results of intensive geological fieldwork done between 1967–1968 (unpublished internal reports of the Romanian Geological Survey, 1968–1969). In the same paper, the authors figured a few inoceramid and ammonite taxa. They also mentioned micro- and macrofossils from the upper part of a sandstone-conglomerate succession and from the basal part of the lower marls – argillaceous succession along the Cheia Valley, that indicated a Senonian age for this interval. The same succession, generically named as “the middle complex”, was described and dated as Coniacian – Santonian in age in the Olănești Valley. On the Cheia Valley, the mentioned authors cited an association with *Inoceramus hercinicus* PETRASCHECK, *I. carpathicus* (SIMIONESCU), *I. lamarcki* PARCKINSON, *I. schloembachi* BOEHM, *I. wandereri* ANDERT, *I. inconstans* MÜLLER, *I.*

deformis MEECK. On the top of this “middle complex”, they found an association with: *Inoceramus involutus* SOWERBY, *I. wandereri* ANDERT, *I. koeneni* MÜLLER, *I. cf. crassus* PETRASCHECK. Near to the confluence of the Prislopel and Cheia valleys, the outcropping marls were dated as Santonian, based on the occurrence of *Lewisiceras* sp. and *Gaudryceras varagurensis* KOSSMAT.

Mihăilescu-Toderiță (1973) made new observations concerning the Upper Cretaceous deposits from the Olănești and Cheia valleys. She recovered from the same marl and clay levels a rich inoceramid fauna with *Inoceramus hercinicus* PETRASCHECK, *I. carpathicus* (SIMIONESCU), *I. involutus* SOWERBY, *I. lamarcki* PARCKINSON, *I. sublabiatus* Seitz, *I. schloembachi* BOEHM. Unfortunately, she described and figured only a few of these species. The mentioned author

referred the previous inoceramid assemblage to the Upper Turonian (?) – Coniacian interval. In the Olănești Valley, she also mentioned the presence of *Inoceramus* aff. *sublabiatus* MÜLLER.

In the proximity of the Upper Jurassic/Lower Cretaceous limestones of the Buila – Vânturarița Massif, along the Cheia and Olănești valleys, the clay beds from the “lower marl – argillaceous sequence” represent the Middle-Upper Coniacian – Lower Campanian interval, as suggested by the foramiferal assemblages (Neagu & Damian, the present volume).

The specimens figured in the present paper were excavated from new outcrops situated on the forest road that sweeps the Olănești Gorges. Near the confluence between the Olănești and Stoia valleys, from the “lower marl – argillaceous sequence” (Middle-Upper Coniacian – Lower Campanian) we identified *Mytiloides* sp. *A*. Near to the confluence between the Olănești and Prislop valleys, a rich macrofaunal assemblage with inoceramids, echinoids, and ammonites was collected. From the same stratigraphic level, but from other outcrops (upstream from the confluence with Surle Valley, on the confluence of the Olănești and Stoia valleys) we collected numerous others inoceramid specimens.

From one outcrop situated on the forest road from the Cheia Valley, near to the tunnel that sweeps the Upper Jurassic/Lower Cretaceous limestones of the Buila – Vânturarița Massif, we collected two macrofaunal assemblages, which can be associated to two different ecological niches.

STRATIGRAPHY

The studied fauna was collected from two richly fossiliferous outcrops with inoceramids, echinoids and ammonites. Other inoceramids were found as solitary specimens in other outcrops. Based on the studied inoceramid taxa, we present a new biostratigraphical interpretation of the studied area, interpretation which is graphically represented on the modified geological map (Fig.1), redrawn after that made by Lupu *et al.*, 1978. One of the outcrops with inoceramids (the outcrop **A**, Fig. 1) is located exactly on the margin (border) of the reef limestone slope of the Buila – Vânturarița Massif, between Olănești and Cheia Valleys. The fauna located in this outcrop is considered to represent a taphocenosis with para-autohtonous character, accumulated in a small depression formed on the Upper Jurassic/Lower Cretaceous reef limestones. The outcrop is represented by Upper Cretaceous (Turonian – Lower Coniacian) grayish micaceous silty marls, without stratification. The inoceramid specimens are represented mainly by internal moulds, in some cases strongly deformed. The general dimensions of the inoceramids are small to moderate and the majority shows a large convexity of the shell, especially toward the ventral margin, where the ornamentation is very dim. In some

specimens it was possible to observe remains of the original shell that reveal 2 mm thickness of the prismatic layer. The associated fauna, ammonites and echinoids, is represented by complete, but also strongly deformed, specimens. These deposits present an extension toward NE, with a gradual transition to a pelitic lithofacies represented by marls and black shales and clays with clear stratification. In Olănești Valley, near to the confluence with Stoia Valley, we collected two inoceramid specimens (*Mytiloides* sp. *A*, Pl. I. fig. 1), strikingly different compared to all the other specimens collected from different outcrops of the studied area.

The second outcrop that provides a rich inoceramid fauna (the outcrop **B**, Fig. 1) is located on the right side of the Cheia Valley (N 45° 15' 04"; E 24° 08' 35"; approximate altitude 657 meters).

Very close to this second location, on the confluence with a right tributary of this valley, Mihăilescu-Toderiță (1973) mentioned another location with inoceramid taxa, as listed previously. Outcrop **B** shows a different lithology and, moreover, this is a new outcrop opened by the new forest road made after 1985. Therefore, the inoceramid fauna collected from this second outcrop is different from the faunas cited by Mihăilescu-Toderiță (op. cit.) and Lupu *et al.* (1978).

Grey and black micaceous marls with clear stratification and with remains of inoceramids, echinoids and ammonites, represent the second outcrop. The general dimensions of the inoceramids range from 3–5 cm to 20–25 cm (the specimens with pronounced convexity of the shell). The inoceramids are very well preserved like internal moulds, with detailed impressions of the mantle characteristics (sectors with vascular impressions), numerous epifaunal traces and other taphonical aspects which will be presented in a future paper. In some specimens the remains of the original shell are well preserved. The aragonite shell in the umbonal region is around 5 mm thick, while in the ventral region is around 1.5–2 mm. In some large specimens the ligament area is very well preserved and the ligament is around 12 mm thick. The external ornamentation is also well preserved in some specimens.

Considering the previous observations, it is considered that the studied fauna includes two different associations (Table 1):

■ The outcrop **A**: the inoceramid fauna is represented by the following species: *Mytiloides* sp. *A*.; *Mytiloides hercinicus* (PETRASCHECK); *Mytiloides mytiloides* (MANTELL); *Mytiloides striatoconcentricus* (GUMBEL); *Mytiloides submytiloides* SEITZ, *Mytiloides labiatus* (SCHLOTHEIM), *Cataceramus* sp.; the age of the deposits was established as Upper Turonian – Lower Coniacian, based on these inoceramid taxa and micropaleontological data, as well as superposition relationships of similar deposits from the adjacent regions (Brezoi Basin, Titești Basin,

Eocen		conglomerate			
Upper Cretaceous (post-tectonic deposits)	Ma ₂	Upper marls - argillaceous sequence		<i>Cremnoceramus brongniarti</i> (MANTELL) <i>Cremnoceramus inconstans</i> (WOODS) <i>Inoceramus pseudowandereri</i> SZASZ <i>Platyceramus mantelli</i> (MERCEY) <i>Inoceramus pseudoinconstans</i> SZASZ <i>Inoceramus falcatus</i> HEINZ <i>Inoceramus ex.gr. hamangiensis</i> SZASZ <i>Inoceramus aff.paradeformis</i> SZASZ <i>Inoceramus danubiensis</i> SZASZ <i>Inoceramus sp. B</i>	outcrop B
	Cp ₂₊₃ - Ma ₁	Upper sandstone - conglomerate sequence			
	Co ₂₊₃ - Cp ₁	Lower marls - argillaceous sequence			
	†† co - st conglomerate, sandstones				
Tu ₃ - Co ₁	Lower sandstone - conglomerate sequence		<i>Mytiloides sp. A.</i> <i>Mytiloides hercinicus</i> (PETRASCHECK) <i>Mytiloides mytiloides</i> (MANTELL) <i>Mytiloides striatoconcentricus</i> (GUMBEL) <i>Mytiloides submytiloides</i> (SEITZ) <i>Mytiloides labiatus</i> (SCHLOTHEIM) <i>Cataceramus sp.</i>	outcrop A	
†† vr - cm polyimitic conglomerates, marls, argillaceous silt, sandstones					
† Lower Aptian	th - km	Bioclastic limestones reef limestones	Limestones 30 - 40 m	† according with Dragastan et al., 2000 †† according with Lupu et al., 1978	

Table 1. Biostratigraphy of the Olănești – Cheia basin.

Szasz, 1975) where the previously mentioned inoceramid taxa have a very good stratigraphic control (Ion *et al.*, 1997, 1998; Szasz, 1979, 1985, 1986, a, b, c; Szasz *et al.*, 1978, 1988; Walaszczyk, 2000; Walaszczyk and Szasz, 1997; Walaszczyk & Wood, 1998).

■ The outcrop B: the inoceramid fauna is represented by the following species: *Cremnoceramus brongniarti* (MANTELL), *Cremnoceramus inconstans* (WOODS), *Inoceramus pseudowandereri* SZASZ, *Platyceramus mantelli* (MERCEY), *Inoceramus pseudoinconstans* SZASZ, *Inoceramus falcatus* HEINZ, *Inoceramus ex.gr. hamangiensis* SZASZ, *Inoceramus aff.paradeformis* SZASZ, *Inoceramus danubiensis* SZASZ, *Inoceramus sp. B*; the Middle - Upper Coniacan – Lower Campanian age was established based on these inoceramids (Ion *et al.*, 1997, 1998; Szasz, 1979, 1985, 1986, a, c; Szasz *et al.*, 1978, 1988; Walaszczyk and Szasz, 1997; Walaszczyk *et al.*, 2001). The presence of the Lower Campanian is also supported by the foraminifera assemblages collected from the internal moulds of the inoceramids and from others outcrops located on the Cheia Valley – Olănești Valley alignment (Neagu & Damian, present volume).

On the Olănești Valley, from the confluence with the Surle Valley and downstream from this confluence, there is a continuous sequence of

micaceous black marls with pronounced stratification, with limonite concretions toward the upper part of the succession. A very large specimen of *Platyceramus mantelli* (MERCEY) (up to 55 cm length, Pl. 6, fig. 2) was collected from these marls. In other outcrops of the same sequence, on the surface of the beds numerous other very large specimens (up to 55 cm length) can be seen. The shells are complete, with articulated valves. Some specimens are transversally eroded with 8–10 cm the maximum inflation of the shell. The prismatic layer is around 1.5 cm thick.

On NE direction, on the Surle Valley, there are other outcrops where solitary specimens of inoceramids, possibly belonging to *Mytiloides* sp. A, can be observed on the surface of stratification.

CONCLUSIONS

The detailed fieldwork conducted in the boundary sector between the Upper Jurassic/Lower Cretaceous reef limestones and the Cretaceous siliciclastic deposits in the area of the Cheia and Olănești valleys; as well as in the southern part of the Olănești valley, allow us to partially modify the geological map of the area, as presented by Lupu *et al.* (1978). The boundaries between the different lithological units were corrected and the age for these units reconsidered

based on the studied inoceramid fauna. We maintain the age Coniacian – Santonian for the conglomeratic level (Table 1., Fig. 1), marked by Lupu *et al.* (1978) on the Vânturarița – Olănești geological map sheet (scale 1:50.000).

Further paleontological and stratigraphical researches will be necessary in this area for a better understanding of the geological evolution of this very interesting sector of the Getic Nappe.

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PLATE CAPTIONS

PLATE 1

Fig. 1 *Mytiloides* sp. A – LPBIIL1952 x0.75; Upper Turonian – Lower Coniacian;
 Figs. 2, 3 *Mytiloides labiatus* (SCHLOTHEIM): 2 – LPBIIL1971 x1; 3 – LPBIIL1960 x1; Upper Turonian – Lower Coniacian;
 Figs. 4, 5, 6 *Cremnoceramus brongniarti* (MANTELL): 4 – 1963 x1; 5 – LPBIIL1975 x1; 6 – LPBIIL1973 x1; Upper Turonian – Lower Coniacian;
 Fig. 7 *Cataceramus* sp. – LPBIIL1956 x1; Upper Turonian – Lower Coniacian;
 Figs. 8, 9 *Mytiloides striatoconcentricus* (GUMBEL): 8 – LPBIIL1990 x1; 9 – LPBIIL1968 x1; Upper Turonian – Lower Coniacian,

PLATE 2

Figs. 1, 2, 5, 6, 7 *Mytiloides mytiloides* (MANTELL): 1 – LPBIIL1987 x1; 2 – LPBIIL1987 x1; 5 – LPBIIL1961 x1; 6 – LPBIIL1986 x1; 7 – LPBIIL1962 x1; Upper Turonian – Lower Coniacian;
 Fig. 3 *Mytiloides hercynicus* (PETRASCHECK), LPBIIL1964 x1; Upper Turonian – Lower Coniacian;
 Fig. 4 *Mytiloides submytiloides* (SEITZ), LPBIIL1953 x1; Upper Turonian – Lower Coniacian.

PLATE 3

Figs. 1, 2, 3 *Cremnoceramus brongniarti* (MANTELL): 1 – LPBIIL1967 x1; 2 – LPBIIL1957 x1; 3 – LPBIIL1957 x1; Middle – Upper Coniacian – Lower Campanian;
 Figs. 4, 5 *Inoceramus pseudoinconstans* SZASZ 4, 5 – same specimen LPBIIL1979 x0.5; Middle – Upper Coniacian – Lower Campanian
 Figs. 6, 7 *Inoceramus* sp. B - LPBIIL1972 x1; Middle – Upper Coniacian – Lower Campanian;
 Fig. 8 *Inoceramus pseudowandereri* SZASZ, LPBIIL1981 x0.75; Middle – Upper Coniacian – Lower Campanian;
 Fig. 9 *Inoceramus danubiensis* SZASZ, 1985 – LPBIIL1966 x1; Middle – Upper Coniacian – Lower Campanian;
 Fig. 10 *Platyceramus mantelli* (MERCEY) – LPBIIL1954 x1; Middle – Upper Coniacian – Lower Campanian.

PLATE 4

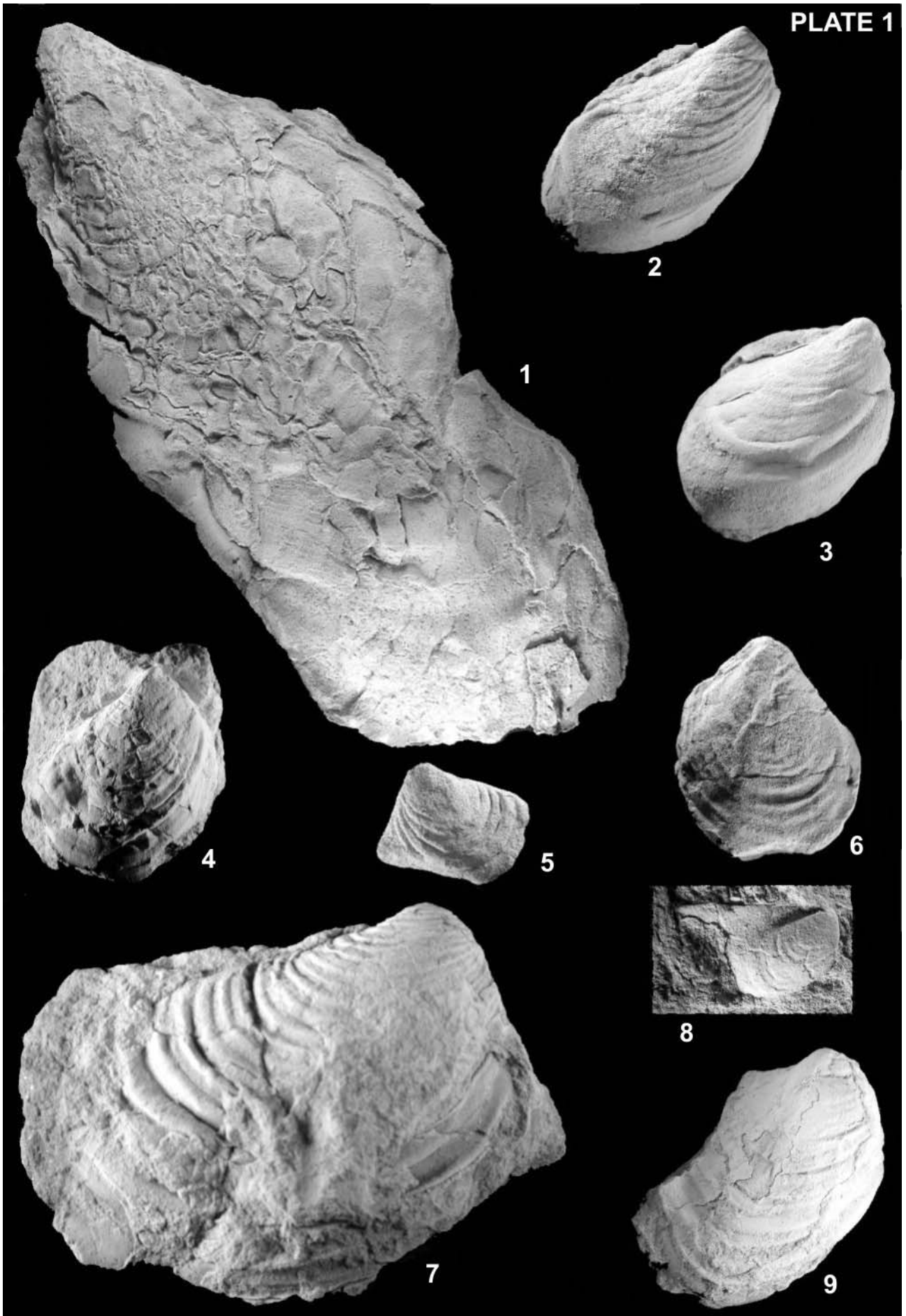
Figs. 1–5; 8–10 *Platyceramus mantelli* (MERCEY): 1 – LPBIIL1991 x0.5; 2 – LPBIIL1991 x0.5; 3 – LPBIIL1980 x0.5; 4 – LPBIIL1984 x0.5; 5 – LPBIIL1994 x0.5; 8 – LPBIIL1982 x0.5; 9 – LPBIIL1982 x0.5; 10 – LPBIIL1978 x0.5; Middle – Upper Coniacian – Lower Campanian;
 Figs. 6, 7 *Inoceramus falcatus* HEINZ: 6 – LPBIIL1988 x1; 7 – same specimen; Middle – Upper Coniacian – Lower Campanian.

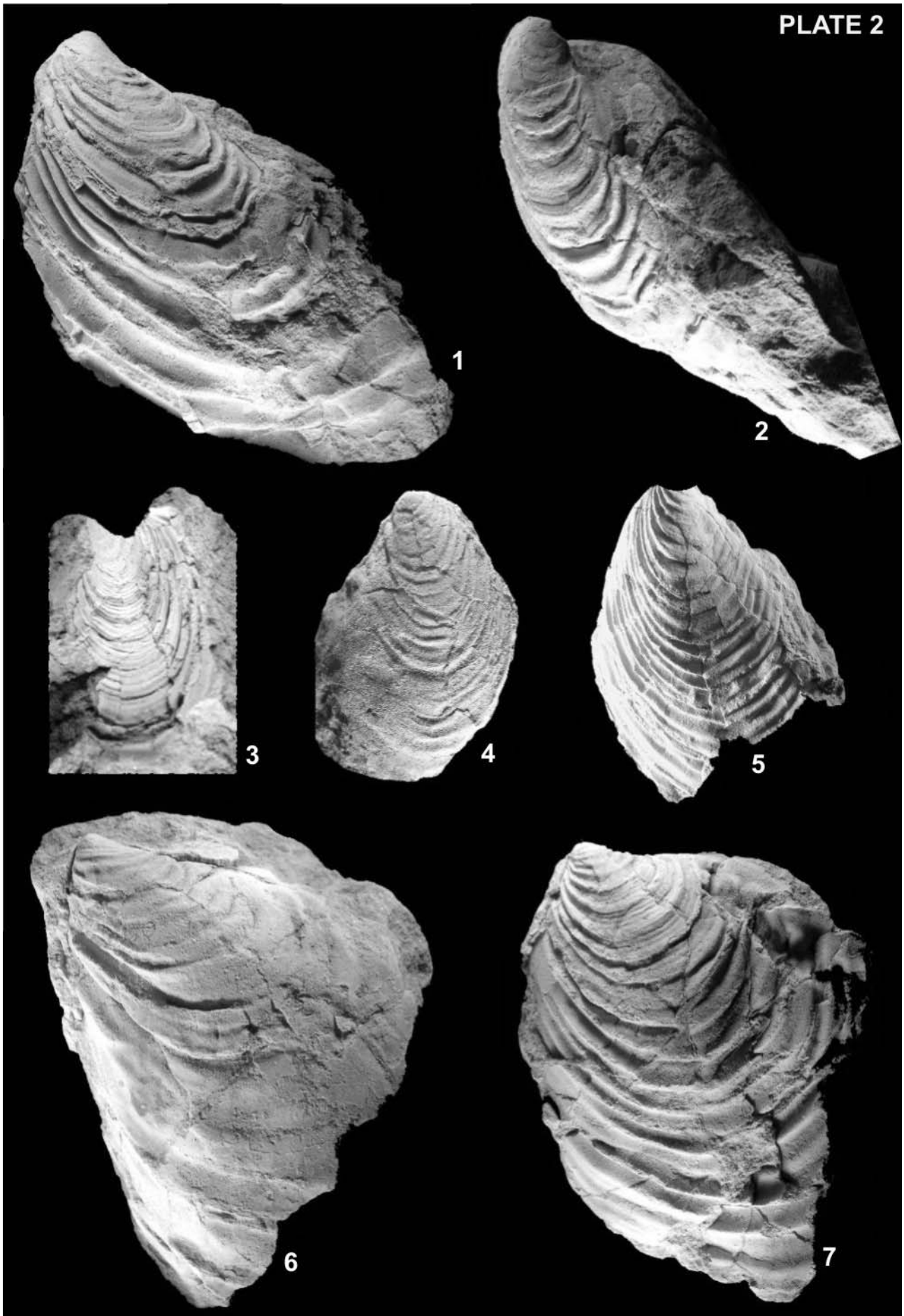
PLATE 5

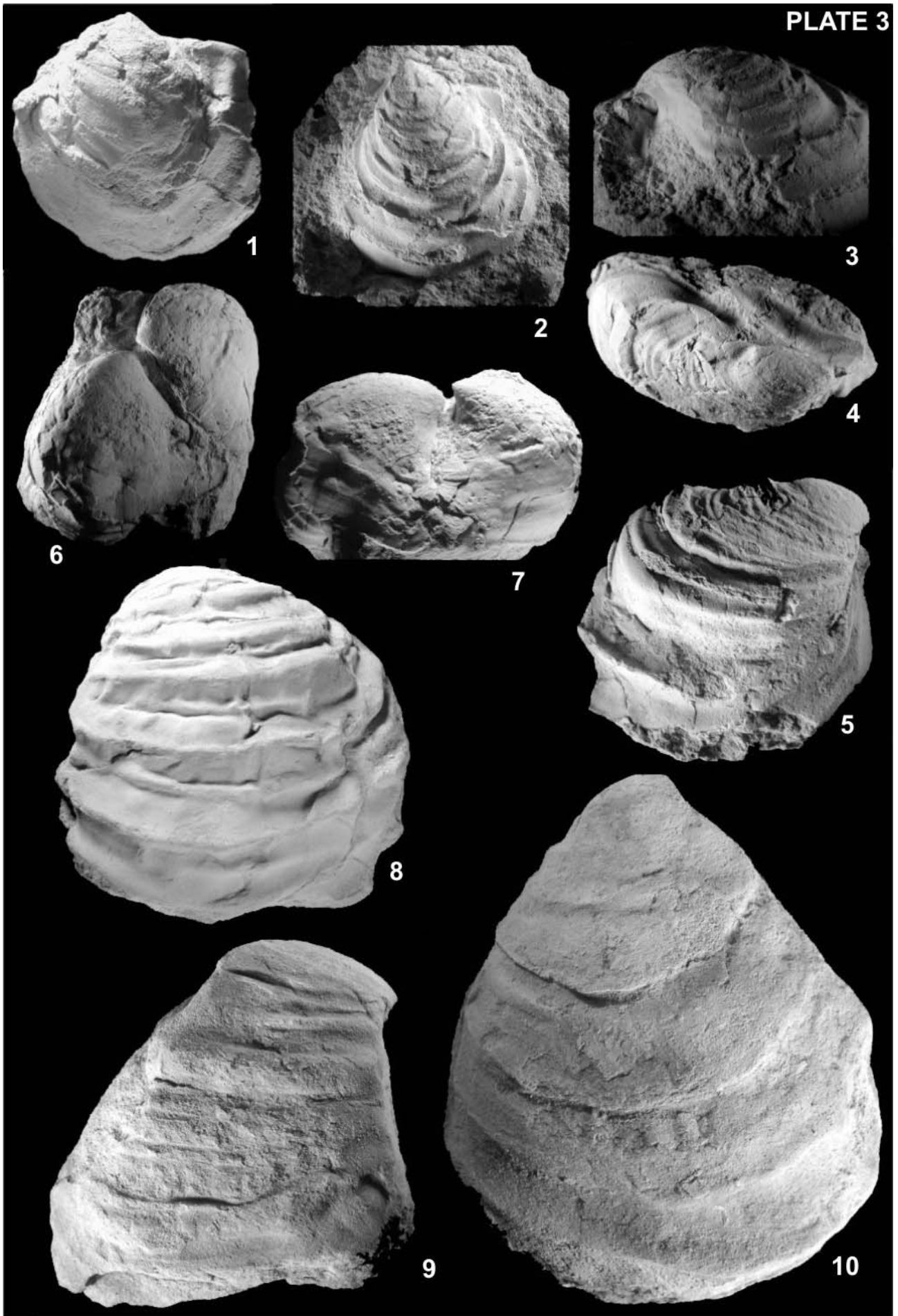
Figs. 1, 5 *Inoceramus pseudowandereri* SZASZ: 1 – LPBIIL1983 x0.75; 5 – LPBIIL1958 x0.5; Middle – Upper Coniacian – Lower Campanian;
 Figs. 2, 3, 6, 7 *Inoceramus* ex. gr. *hamangiensis* SZASZ: 2 – LPBIIL1995 x0.5; 3 – LPBIIL1995 x0.5; 6 – LPBIIL1992 x0.5; 7 – LPBIIL1992 x0.5; Middle – Upper Coniacian – Lower Campanian;
 Fig. 4 *Inoceramus pseudoinconstans* SZASZ – LPBIIL1976 x1; Middle – Upper Coniacian – Lower Campanian;
 Figs. 8, 9 *Cremnoceramus inconstans* (WOODS): 8 – LPBIIL1970 x1; 9 – LPBIIL1970 x1; Middle – Upper Coniacian – Lower Campanian.

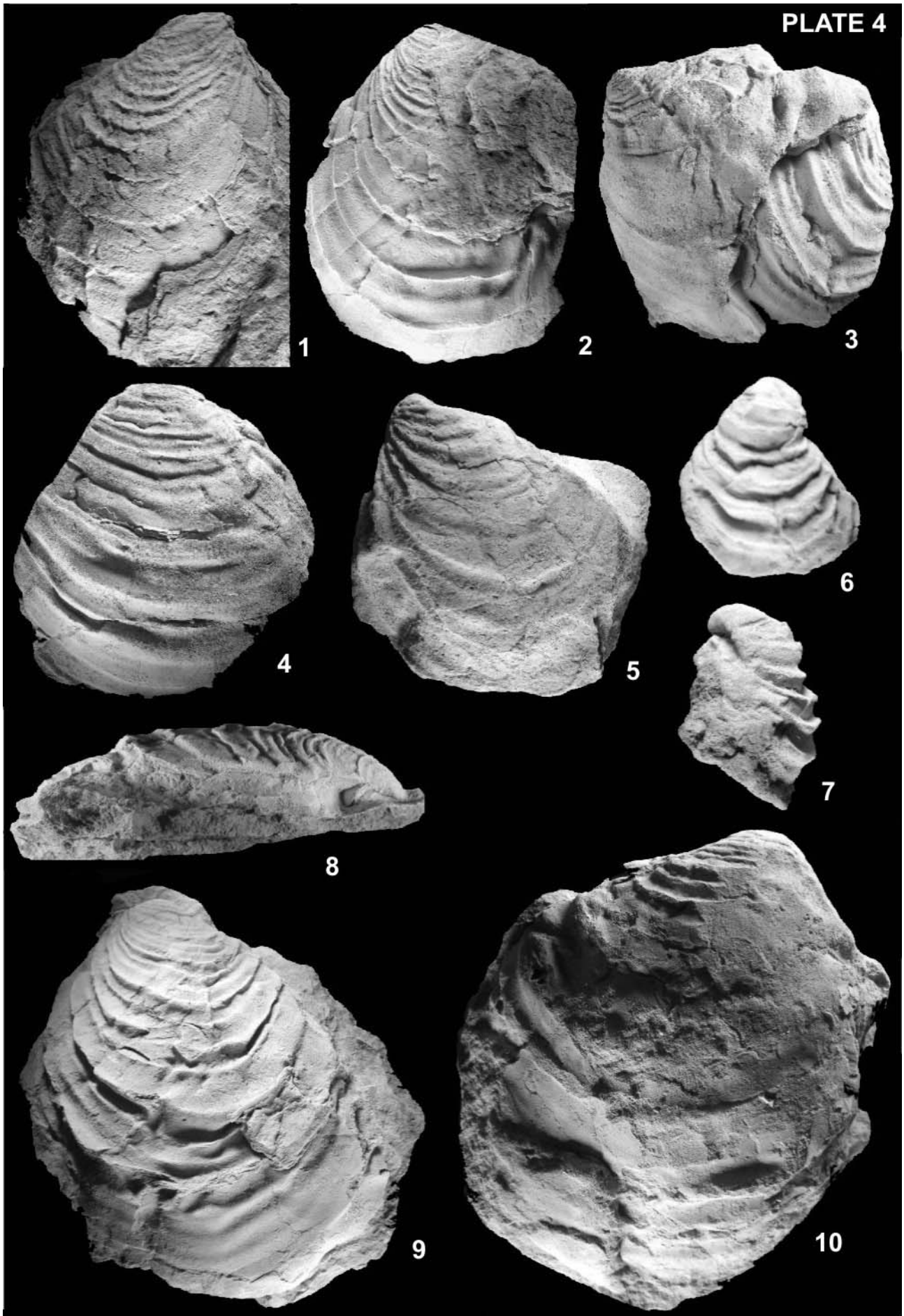
PLATE 6

Fig. 1 *Inoceramus* aff. *paradeformis* SZASZ - LPBIIL1993 x0.5; Middle – Upper Coniacian – Lower Campanian.
 Fig. 2 *Platyceramus mantelli* (MERCEY) - LPBIIL1996 x0.35; Middle – Upper Coniacian – Lower Campanian.









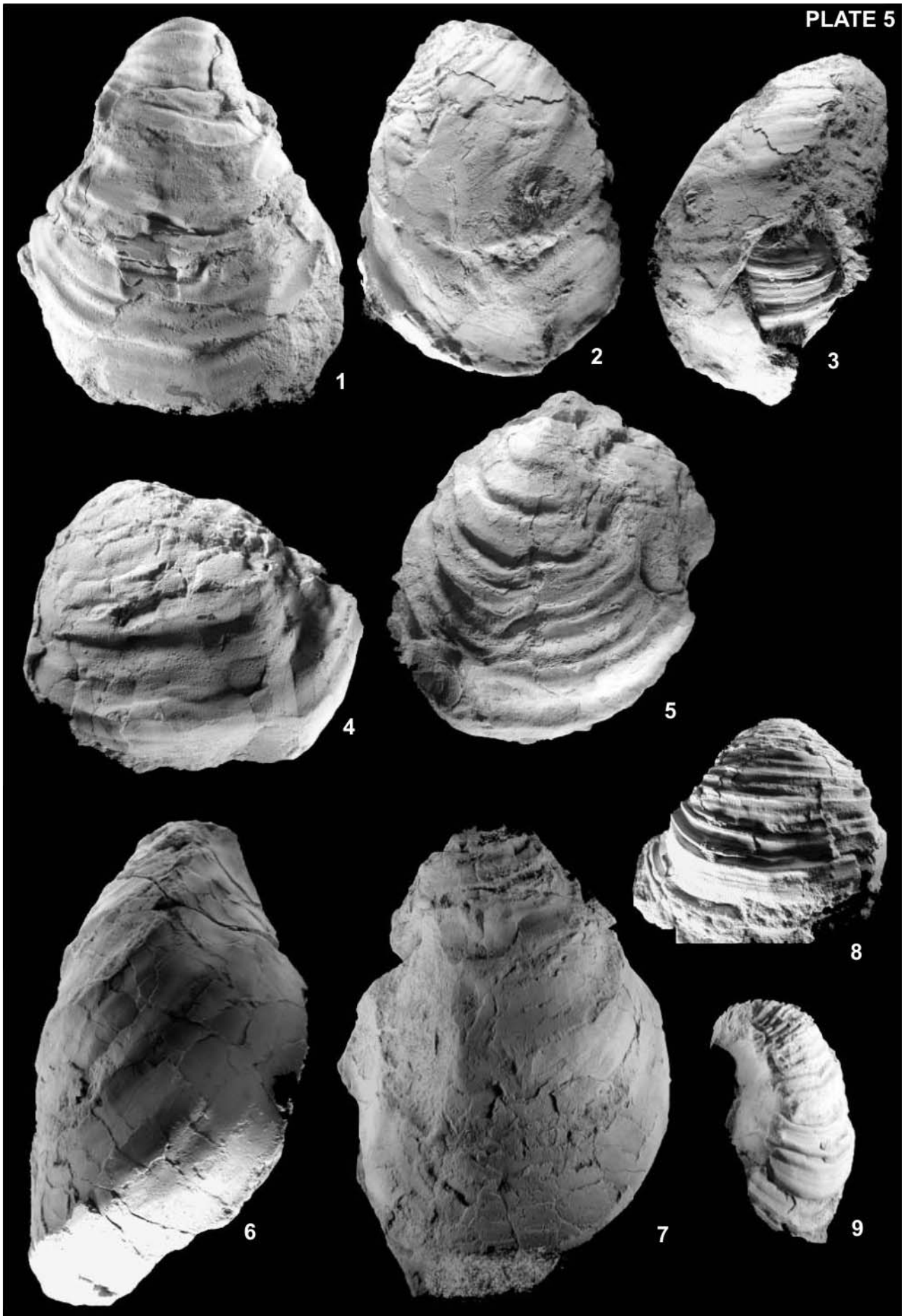


PLATE 6

