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Csernye revisited: New ammonite finds and ostracods from the Lower Jurassic Pliensbachian/Toarcian boundary beds in Bakonycsernye, Transdanubian Hungary

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Abstract

Recently a new exposure near the classic outcrops at Bakonycsernye made possible to make a closer study on the Pliensbachian/Toarcian boundary beds. Careful sampling and the re-investigation of formerly collected but unpublished material (ammonites and microfossils) evidenced that in the new section the hiatus between the Pliensbachian massive red limestone and the Toarcian claymarl is much shorter than suggested before, on the basis of previous exposures. The earliest Toarcian ammonite in the new section is *Paltarpites* cf. *paltus* of the Paltus Subzone, while the earliest Toarcian ammonites in the classic Csernye section indicated the Falciferum Zone. The ammonite fauna shows no abrupt change at the chronostratigraphic boundary: most of the represented morphological lineages are continuous across, while the ostracod fauna, having been represented by benthonic forms, reacted heavily to the limestone to claymarl facies change at the boundary: the former sublittoral elements are replaced by deper-water forms in the Toarcian. To document these circumstances and changes, the most important ammonites and ostracods from the new section and from the boundary beds of the classic Csernye section are figured and stratigraphically evaluated.

Introduction

The Jurassic sequence of Csernye (Bakonycsernye, Text-fig. 1) became classic through the pioneering works of HANTKEN (1870) and PRINZ (1904), and later as one of the standards of Mediterranean Liassic and Aalenian stratigraphy by the re-examination by GÉCZY (1966, 1967). The original locality has been the so-called Tűzköves-árok ('Chert Gorge'), the valley running down to the former Kisgyón coal mine (Eocene), administratively belonging to village Isztimér, but traditionally referred to the nearer Bakonycsernye. In the valley the Middle Liassic limestones were exploited in a quarry, while the younger, Upper Liassic and lower Middle Jurassic beds were exposed in the gorge uphill.

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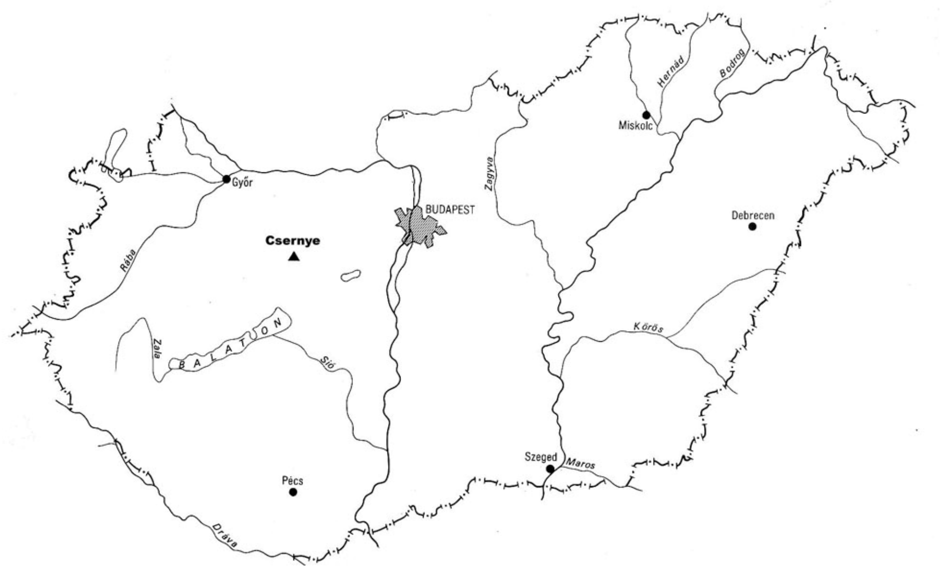

Fig.1. Bakonycsernye in Hungary

The quarry became abandoned in the early 1900s, and a new excavation was made only in 1969 (Fig. 2), when the International Mediterranean Jurassic Colloquium visited the locality (FÜLÖP et al. 1969). Later the fossils from this new section have been identified and published (GÉCZY 1974).

Nowadays the section and the exposures in the gorge are covered by scree, thus unaccessible for studies. However, a part of the succession had been exposed by landslides recently. This portion is luckily the Pliensbachian/Toarcian boundary interval. This new section is called here Section N. The renewed interest toward the geological and biotic changes at this boundary makes reasonable a complex paleontologic/stratigraphic re-examination of these beds. As comparison, the material of the section starting in the old quarry, and having been measured and collected in 1968 was also re-examined, and additional micropaleontological samples were also collected. This is the same section (Section A) which was examined for Upper Pliensbachian ammonites by GÉCZY & MEISTER recently (1998).

The local significance of the new section lies in the fact that while previously, on the basis of studies on Section A, the basal Toarcian Tenuicostatum Zone have been regarded as missing, in lack of diagnostic ammonites (GÉCZY 1974), the new section yielded poorly preserved, but determinable ammonites immediately above the Pliensbachian limestone. These ammonites, together with the micropaleontological material prove the presence of the lowermost Toarcian ammonite zone, too.

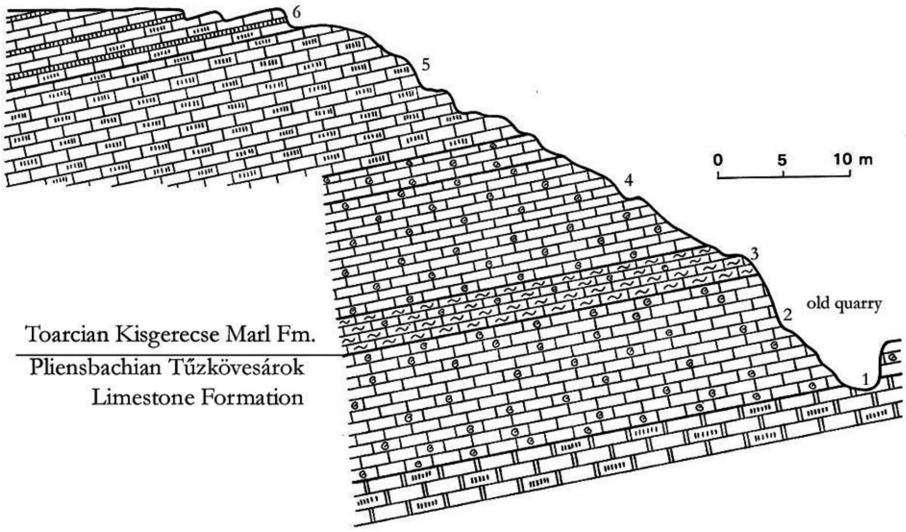

Fig. 2. The classic section (A) of the Bakonycsernye Tűzkövesárok, ont he basis of excavations made for the Mediterranean Jurassic Colloquium, Budapest, 1969 (after KONDA, 1989). 1 = Sinemurian grey cherty limestone; 2 = Pliensbachian red massive limestone; 3 = Lower and Middle Toarcian red clayey marl; 4 = Upper Toarcian–Aalenian nodular marly limestone; 4 = Lower Bajocian greyish-greenish siliceous limestone; 5: Bajocian to ?Bathonian siliceous, ammonite-free limestone; 6: ?Bathonian–Callovian radiolarite.

Description of the sequences

The studied new section (Section N) is situated above the old quarry, about 20 m south to the former southern wall of the mine, opposite to the main artificial section (Section A) starting from the northern wall of the quarry. The following detailed descriptions are given from the top to the bottom (Fig. 3).

Section N

The exposure shows a ca. 2 m thickness of carbonate rocks. In the lower part limestone dominates, with marly interbeds upwards, then claymarl succeeds (Fig. 2).

Bed E – Dark red, fine-grained, foliated clayey marl. It is the uppermost portion of the exposed sequence. It shows no distinguishable layers within. The lowermost part (3–5 cm) gave several ammonite specimens (*Calliphylloceras, Lytoceras, Paltarpites*), and some belemnites and a nautilid.

thickness……..……… > 1.00 m

Bed D – Greyish-red limestone with vertical partings. It weathers into 3–4 cm angular fragments. Its surface is covered with a 3–5 mm thick ferromanganese crust (hardground). Yielded a few belemnite rostra.

thickness ……...…………0.20 m

Bed C – Pale reddish, greyish-pink laminted, soft, clayey marl weathering yellow. The weathered lamellae are 1 to 2.5 cm thick. Sharply delimited from the overlying limestone. Yielded a modest ammonite fauna with *Calliphylloceras, Zetoceras* and *Protogrammoceras*.

thickness..……....………..0.32 m

Bed B – Red, clayey, nodular limestone. Its undulating surface shows transition into the clayey marl above. Yielded a few belemnite rostra.

thickness ….……………..0.22 m

Bed A – greyish-creamy massive limestone with green clay seams. Its 1 cm thick uppermost part is exfoliated as gray clay laminae which grade into a 3 to 5 cm thick red, foliated claymarl. The bed yielded an *Emaciaticeras* specimen.

thickness ……………….…0.08 m

Bed Y – greyish, slightly nodular limestone with uneven surface covered by some millimetres of reddish clay. No macrofauna.

thickness ……………..…0.12 m

Bed X – a massive, yellowish-red, partly greyish limestone bed, showing a threefold (of 20, 21 and 5 cm) inner partition. Its surface is uneven, somewhat stylolithic, giving a tight bond to the bed above.

thickness ………………. 0.46 m

Section A

The section comprised the former quarry wall, which practically represented the whole Pliensbachian. The beds above (Toarcian, Aalenian and beyond, up to the higher Middle Jurassic radiolarite) were excavated for the field trip of the Mediterranean Jurassic Colloquium in 1969 (FÜLÖP et al. 1969). We used the manuscript report written in 1967, and made some additional field observation.

Bed 67 and above – Dark red, clayey marl disintegrating into thin layers and nodules. Ammonites (*Hildaites* spp., *Hildoceras* spp.) are frequent, but mainly fragmentarily preserved. Inner whorls are usually missing in the clayey marl, while better preserved in the more calcareous portions.

thickness ………………….. 0.35 m

Bed 68 – Massive limestone bed with sporadic ammonites (*Canavaria* sp.), and with ferromanganese crust (hardground) on top.

thickness …………………. 0.18 m

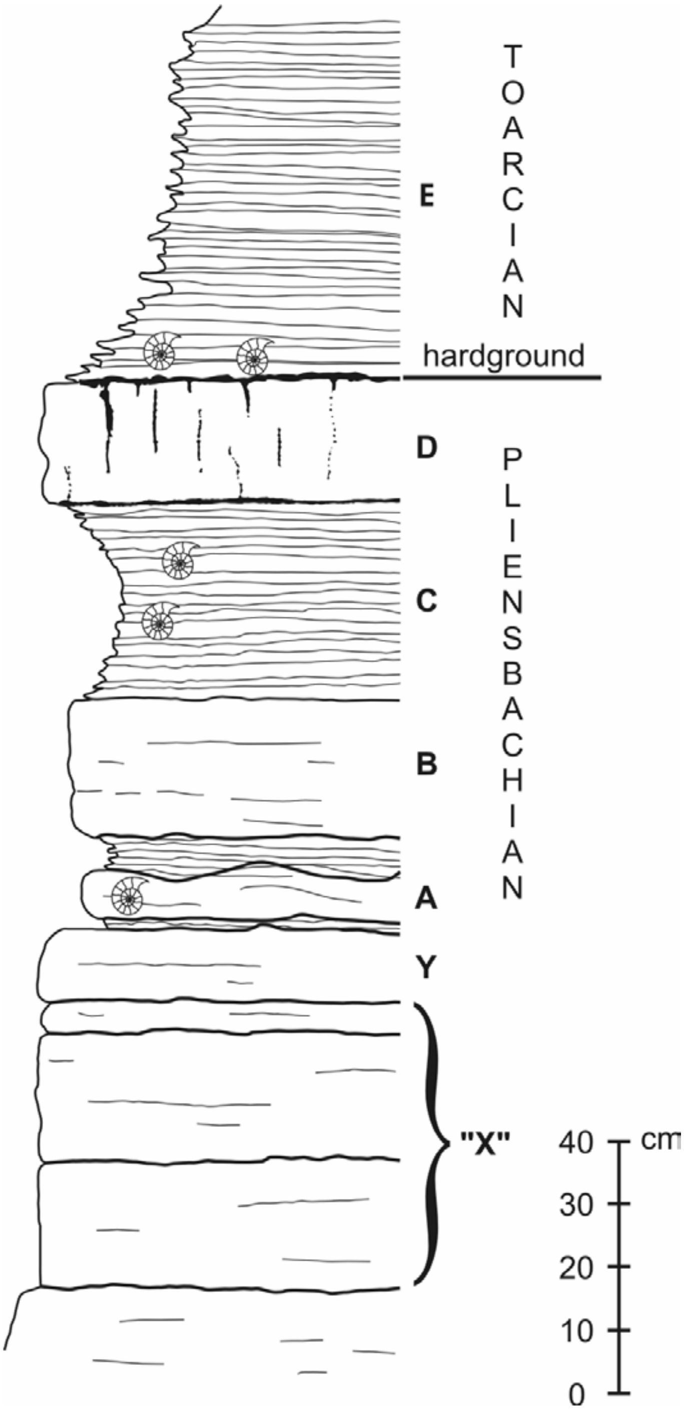

Fig. 3: The new section exposing the Pliensbachian/Toarcian boundary beds

Bed 69 – Reddish-grey limestone with reduced ammonite content, mainly phylloceratids, *Fuciniceras, Canavaria* and *Emaciaticeras*.

thickness ………………….. 0.13 m

Further beds downwards – Massive red limestone with rich ammonite content, discussed in detail recently by GÉCZY & MEISTER as section Csernye A (1988, text-fig. 8).

Lithostratigraphy

The here studied sections show the boundary of two lithostratigraphic units, both widely distributed in the Transdanubian Range. According to former data (KONDA 1989) the limestone beds in the lower part of the profile belong to the Tűzkövesárok Limestone forming the upper part of the here defined formation. The overlying clayey marl represents the basal part of the Kisgerecse Marl Formation. The two formations are markedly separated by the hardground mentioned previously by GÉCZY (1974, p. 411).

Fig. 4: The hardground on top of Bed 68 in Section A. Uppermost Pliensbachian massive red limestone covered by red claymarl here of Serpentinum Zone age. From a color slide made in the 1970s.

Ammonite stratigraphy

The ammonites of the Pliensbachian/Toarcian boundary beds of Csernye had been studied formerly in several works. The most recent monograph (GÉCZY & MEISTER 1998), treating the Domerian ammonites of the Bakony Mts described two sections (A and B) from Csernye, both displaying the uppermost Pliensbachian and one showing also the basal Toarcian beds. Géczy and Meister designated an uppermost ammonite faunal horizon for the Pliensbachian, the „*Emaciaticeras* gr. *fervidum* horizon", which is represented in Csernye with the ammonitids *Lioceratoides* sp., *Emaciaticeras* gr. *fervidum*, ?*Tauromeniceras* sp. (Section A) and *Tauromeniceras* sp. (Section B). Additionally, *Zetoceras iudicariense* (HAAS, 1913) seems to be appearing here also in this horizon (GÉCZY & MEISTER 1998, figs 8, 9 and p. 95). This horizon was recognized in both sections in one layer: in the lower part of Bed 69 in Section A and in Bed 1 of Section B. The lowermost Toarcian was identified in the upper part of Bed 69 in Section A, on the basis of an ammonite determined as *Dactylioceras* aff. *pseudocommune* FUCINI, 1935.

The hardground separating the lower Tűzkövesárok Limestone from the overlying Kisgerecse Marl appears on top of Bed 69, i.e. the limestone bed above this biostratigraphic boundary (Fig. 4). A re-investigation of the specimen which was identified as *Dactylioceras* aff. *pseudocommune* resulted in the revised opinion that it is a Pliensbachian form. The specimen, which is refigured here (Pl. 8, figs 5–6), matches well the figures in FISCHER 1966 (pl. 1, fig. 5, pl. 4, figs 3 and 6), FARAONI et al. 1994 (Pl. 3, fig. 1, pl. 4, figs 1, 2, 3, 5) all records from the upper Pliensbachian. The very similar type series (FUCINI 1934, pl. 9, figs 1–3) came also from the uppermost Pliensbachian. Moreover, the uppermost massive limestone bed (Bed 68), immediately above Bed 69, yielded Upper Pliensbachian ammonites: *Canavaria* cf. *haugi* (GEMMELLARO, 1886) (Pl. 6, fig. 1), *Protogrammoceras* cf. *bassanii* (FUCINI, 1910) (Pl. 7, fig. 4).

Accordingly, if *Dactylioceras* aff. *pseudocommune* defines a faunal horizon, it would be ranged into the topmost Pliensbachian. Bed 69 seems to be indivisible, and is charcterised by various *Emaciaticeras* species. These were omitted from the monograph of GÉCZY & MEISTER (1998), so some of them are figured here: *Emaciaticeras* cf. *emaciatum* (CATULLO, 1853) (Pl. 4, fig. 2), *Emaciaticeras*? sp. (Pl. 4, fig. 1).Other elements are Phylloceratids (*Phylloceras iudicariense* HAAS, 1913, Pl. 1, figs 2–3; *Partschiceras* sp., Pl. 2, fig. 1), *Fuciniceras* cf. *cornacaldense* (TAUSCH, 1890), (Pl. 6, fig. 5), *Canavaria* cf. *ducetiana* FUCINI, 1931 (Pl. 4, figs 3–4) and *Lioceratoides* sp. (Pl. 6, fig. 2).

The overlying basal bed of the red claymarl in Section A yielded Falciferum Zone ammonites: *Hildaites* cf. *forte* (BUCKMAN, 1921) (Pl. 8, figs 1–2), *Hildaites crassus* (GUEX, 1973) (Pl. 7, figs 5–6) and *Hildoceras* spp. (Pl. 7, fig. 3; Pl. 8, figs 3–4). On the basis of these records indicating the Falciferum Zone, the hiatus above the hardground-capped massive limestone was estimated as representing one ammonite zone (the Tenuicostatum Zone, see GÉCZY 1974).

In the new section (N) the beds below the lithofacies change gave sporadic ammonites. Most significant is the *Emaciaticeras emaciatum* specimen from Bed A (see description below), which indicates a correlation with Bed 69 of Section A. Higher up, in Bed C poorly preserved ammonites: *Zetoceras* sp., *Calliphylloceras* cf. *bicicolae*, *Lytoceras* cf. *baconicum* and *Protogrammoceras* cf. *bassanii* occured (descriptions below), which make possible a correlation with Bed 68 of Section A.

The uppermost excavated bed (Bed E) of Section N gave a limited fauna with *Lytoceras* sp. (Pl. 3, figs 1–2), *Zetoceras* cf. *zetes*, *Calliphylloceras* sp. and a nautilid (*Cenocoeras* sp.), and most importantly *Paltarpites* cf. *paltus* (description of the ammonites from the new section see below). *Paltarpites paltus*, being the index of the basal Toarcian subzone within the Tenuicostatum Zone indicates the presence of the lowermost Toarcian immediately above the lithofacies change and the developed hardground in this new section.

Description of ammonites from the newly excavated section (Section N)

Zetoceras cf. *zetes* (D'ORBIGNY, 1850)
Pl. 1, fig. 1

1845 *Ammonites heterophyllus amalthei* – QUENSTEDT in 1845–49, p. 100, pl. 6, fig. 1a–c.
1850 *Ammonites zetes* D'ORBIGNY, 1850 – D'ORBIGNY in 1842–51, p. 247.
2000 *Zetoceras zetes* (D'ORBIGNY, 1850) – JOLY, p. 65, pl. 10, fig. 6, pl. 12, figs 1, 2a–b, figs 125–131.
2007 *Zetoceras zetes* (D'ORBIGNY, 1850) – GÉCZY & MEISTER, p. 149, pl. 2, figs 3, 7.

An internal mould of a single, bigger phragmocone with deep umbilicus, nearly parallel, outwardly convergent flanks and wide, somewhat rounded venter.

Z. zetes is a species of long vertical range (from the Early Sinemurian up to the late Domerian or possibly earliest Toarcian), which is distributed from the Western Tethys to the Pontids, and in France, Germany and England within the Euboreal realm.

The specimen came from Bed C (Upper Pliensbachian) of Section N.

Calliphylloceras cf. *bicicolae* (MENEGHINI, 1874)
Pl. 2, figs 2, 4–5

1874 *Phylloceras bicicolae* – MENEGHINI, p. 106.
2000 *Calliphylloceras bicicolae* (MENEGHINI, 1874) – JOLY, p. 71, pl. 14, figs 1–5, figs 139–142.
2007 *Calliphylloceras bicicolae* (MENEGHINI, 1874) – GÉCZY & MEISTER, p. 148, pl. 1, fig. 7.

Three moderately preserved, medium size specimens. The umbilicus is rather wide, the flanks are slightly convex, nearly parallel, the venter is rounded. There are 4 or 5 prorsiradiate constrictions on the flanks.

C. bicicolae is a persistent species, with range from the Early Sinemurian to the middle Taorcian. Its geographic dsitribution is also wide, with Tethyan occurrences from Hispania to the Pontides (Anatolia), while in the Toarcian it reached the southern margin of the Massif Central (Gard, Lozère).

The specimens came from Bed C (Upper Pliensbachian) of Section N.

Lytoceras cf. *baconicum* VADÁSZ, 1910
Pl. 2, fig. 3

1910 *Lytoceras baconicum* – VADÁSZ, p. 75, figs 24, 25.
1998 *Lytoceras* gr. *baconicum* VADÁSZ 1910 – GÉCZY & MEISTER, pl. 6, fig. 1.

A single, medium size internal mould of moderate preservation. The umbilicus is extremely wide, the whorls just touch each other, and their whorl-height grows rapidly. The whorls are narrower than those of the type.

L. baconicum is a rare species, having been recorded from the Bakony Mts and from the Domerian of the Southern Alps.

The specimen came from Bed C (Upper Pliensbachian) of Section N.

Emaciaticeras emaciatum (CATULLO, 1853)
Pl. 5, figs 1–2

1853 *Ammonites emaciatus* – CATULLO, p. 35, pl. 4, fig. 2.
1983 *Emaciaticeras emaciatum* (CATULLO, 1853) – BRAGA, p. 282, pl. 13, figs 28–31; pl. 14, fig. 1.
1997 *Emaciaticeras emaciatum* (CATULLO 1853) – DOMMERGUES, p. 17, pl. 2, fig. 26.

A single, medium size, well-preserved internal mould with wide umbilicus, narrow, slightly emerged ventral keel bordered by shallow furrows. The strong, narrow, rigid, radial ribs bacome stronger toward the keel, then fade out completely. There are 10 ribs on a half-whorl.

The here studied specimen has narrower umbilicus than the type from Northern Italy (Feltre, Belluno), but matches well the specimens from Appenines figured by FUCINI (1930). *E. emaciatum* is known exclusively from West Mediterranean areas (Italy: Lombardian Alps, Appennines, Iberia: Betic Cordilleras). FUCINI (1930, p. 120) suggested that the specimen described by KULCSÁR (1914) from the Gerecse (North Transdanubian Hungary) as *Arieticeras Bertrandi* could be ranged into *E. emaciatum*.

According to BRAGA (1983) *E. emaciatum* is the index form in the Elisa Subzone of the Upper Pliensbachian Emaciatum Zone.

The specimen came from Bed A (Upper Pliensbachian) of Section N.

Protogrammoceras cf. *bassanii* (FUCINI, 1900)
Pl. 5, fig. 3; Pl. 6, fig. 3

1900 *Grammoceras bassanii* FUC. – FUCINI in 1899–1900, p. 46, pl. 10, figs 6,7.
1972 *Protogrammoceras* (*Bassaniceras*) *bassanii* (FUCINI) – CANTALUPPI, p. 343, pl. 16, figs 1, 2.
1983 *Protogrammoceras bassanii* (FUCINI, 1900) – BRAGA, p. 175, pl. 6, figs 3–5.

A single, bigger, moderately preserved internal mould with a quarter-whorl preserved body chamber fragment. The umbilicus is moderately wide. The slightly convex flanks are sculptured by faint, falcoid ribs, which are equal in width the intercostal spaces. The venter is wide, flattened, with broad, low keel.

The Csernye specimen is closer to the specimen described by FUCINI and refigured by CANTALUPPI (1972, pl. 16, figs 1, 2) than to the ones documented by FARAONI et al. from the E. mirabilis Subzone (1994, p. 256, pl. 10, figs 2, 3, 5).

According to BRAGA (1983), *P. bassanii* belongs into the Elisa Subzone of the Emaciatum Zone, and possibly ranges up into the Solare Subzone. The species occurs in Italy (Lombardy, Apennines) and Iberia (Subbetic Cordilleras).

The specimen came from Bed C (Upper Pliensbachian) of Section N.

Paltarpites cf. *paltus* BUCKMAN, 1922
Pl. 7, figs 1–2

1922 *Paltarpites paltus*, nov. sp. – BUCKMAN in 1909–1930, pl. 362A.
2006 *Protogrammoceras* (*Paltarpites*) *paltum* (BUCKMAN, 1922a) – BÉCAUD, p. 45, pl. 1, figs 1, 2, 4, 5.

A single, medium-size, poorly preserved, incomplete internal mould. The body chamber is missing. The umbilicus is wide, the umbilical wall cannot be seen. The flattened, nearly parallel flanks are covered by sigmoid ribs which are slightly wider than the intercostal spaces. The ventrolateral shoulder is rounded, the venter is narrow and slightly convex. The ribs become strongly proverse on the venter, reaching the keel.

P. paltus is a rare but widely distributed species. It occurs in Europe (e.g. in England, France, Iberia and Italy), in North America (British Columbia, Alaska, Arctic Canada) and in Japan. The occurrence in Morocco is doubtful.

P. paltus characterises the basal Toarcian (Paltus horizon, Tenuicostatum Zone) of Europe.

The specimen came from Bed E (basal Toarcian) of Section N.

Ostracod studies

All beds of the here studied sections yielded rich ostracod material. The lower, Pliensbachian part (Section N: Beds X to D and Section A: the reddish-greyish limestone below the red claymarl) gave the following forms

Polycope sp.
Pseudohealdia acuticauda MONOSTORI, 1996 (Pl. 9, fig. 3)
Ogmoconcha amalthei (QUENSTEDT, 1858) (Pl. 9, fig. 4)
Ogmoconcha? sp.
Ogmoconchella? sp. (Pl. 9, fig. 6)
Cardobairdia liassica (DREXLER, 1958) (Pl. 9, fig. 7)
Bairdia longoarcuata MONOSTORI, 1996 (Pl. 9, fig. 8)
Bairdia michelseni arcuatocauda MONOSTORI, 1996 (Pl. 10, fig. 1)

Ptychobairdia lordi MONOSTORI, 1996 (Pl. 10, fig. 2)
Ptychobairdia spp. (Pl. 10, figs 3–5)
Lobobairdia rotundata MONOSTORI, 1996 (Pl. 10, figs 6–7)
Macrocypris? sp. (Pl. 10, fig. 8)
Liasina lanceolata APOSTOLESCU, 1959 (Pl. 11, fig. 1)
Fabalicypris? sp. (Pl. 11, fig. 2)
Bythocypris? cf. *faba* KNITTER, 1983 (Pl. 12, figs 3–4)
Isobythocypris? aff. *postera* HERRIG, 1979 (Pl. 11, fig. 5)
Paracypris redcarensis BLAKE in BLAKE & TATE, 1876 (Pl. 11, fig. 3)
Paracypris sp. (Pl. 11, fig. 4)

Nearly half of these species are known hitherto from the Bakony Mts (MONOSTORI 1996).

The lower (X to B) beds of the Pliensbachian part of Section N is characterised by the dominance of *Lobobairdia rotundata*, with the common *Ogmoconcha amalthei*, *Polycope* sp., *Cardobairdia liassica* and *Isobythocypris*? aff. *postera*. In the uppermost Pliensbachian beds (C and D) *Isobythocypris*? aff. *postera*, *Cardobairdia liassica, Paracypris redcarensis* and *Polycope* sp. occur in great quantitites, *Ogmoconcha amalthei* is relatively common, while *Lobobairdia rotundata* is comparatively rare.

The Toarcian (Bed E in Section N and the red claymarl in Section A) yielded the following species:

Polycope sp.
Cytherella sp. (Pl. 11, fig .6)
Cardobairdia cf. *infalata spinosa* MONOSTORI, 1995 (Pl. 11, fig. 7)
Cardobairdia sp. (Pl. 11, fig. 8)
Bairdia cf. *guttulae* HERRIG, 1979 (Pl. 12, fig. 1)
Bairdia michelseni arcuatocauda MONOSTORI (Pl. 12, fig. 2)
Bairdia cf. *michelseni* HERRIG, 1979
Bythocypris? *faba* KNITTER, 1983 (Pl. 12, figs 3–4)
Paracypris sp.
Pontocyprella cf. *cavata* DONZE, 1967 (Pl. 12, fig. 5).

In the fauna *Pontocyprella* cf. *cavata* and *Bythocypris*? *faba* show mass occurrence, and *Cardobairdia* sp., *Bairdia* cf. *michelseni*, *Polycope* sp. and *Paracypris* sp. are common elements.

The Pliensbachian and Toarcian ostracod faunas show significant differences which are usually interpreted as related to the Lower Toarcian anoxic event. The main change is the disappearance of the Healdidae in the Lower Toarcian. The disappearance of this characteristic and frequently dominant Pliensbachian group has been recorded from several European sections (see RIEGRAF 1985, LORD 1988, LORD & BOOMER 1990, BOOMER 1992, HARLOFF 1994, LORD 1994, ANDREU et al. 1995, BODERGAT 1997, BODERGAT et al. 1998, BOOMER et al. 1998, ARIAS & LORD 1999, ARIAS & WHATLEY 2005).

The characteristically sculptured bairdiids (*Lobobairdia, Ptychobairdia*), which are common from the Triassic, disappear with Healdidae. However, this is a less conspicuous change, because other sculptured Bairdiaceae occur later (e.g in the Bajocian of the Somhegy, Bakony Mts, see MONOSTORI 1995), and some even live today. The fall of the formerly flourishing sculptured Bairdidae can be connected to the break-up and submersion of the Triassic carbonate platforms. The faunas, having been long adapted to this special environment, could not stand the bottom deepening, and were substituted in the here studied Toarcian beds by a less diverse, moderately sculptured fauna of low species and high specimen number.

The difference from the mentioned West European faunas is in the representation of the genera *Ogmoconcha* and *Ogmoconchella*. These are still present in the West European Tenuicostatum zone, but are missing from the same level in Bakonycsernye, in spite of the otherwise high specimen numbers of the fauna.

Remarkable is the lack of Cytheracea from the basal Toarcian samples, because the flourishing of this group in the lowermost Toarcian is the other characteristic feature in other European sections besides the disappearance of the genera *Ogmoconcha* and *Ogmoconchella*. The Bakonycsernye section, with the red clayey marl present, does not show evident signs of anoxia. The fact that the Cytheracea remain subordinate also in the higher Toarcian beds of the section can be due to the deep water conditions. Otherwise, in the higher Toarcian beds the smooth forms remain dominant, while specimens with bigger individaul sizes become characteristic.

Conclusions

The re-investigated Csernye sections show that in condensed sequences, where thicknesses are reduced and diagnostic fossils are rare, the representation of short stratigraphic intervals is occasional. The intermittent sedimentation left only fragmentary record of the reduced deposits and embedded faunal elements alike. In the short distance (ca. 20–30 m) which separates the here described sections differences of at least subzonal scale may appear. The new discoveries indicate that the time of non-depostion above the Upper Pliensbachian limestone which was enough to develop a ferromanganese-encrusted hardground in Section A could have been restricted to a shorter diasteme in Section N, quite understandable in this case of facies change from limestone to clayey marl.

The ammonite faunas show the general tendecies: some lineages (e.g. those of *Zetoceras, Calliphylloceras, Protogrammoceras→Paltarpites*) endure into the Toarcian, other elements (e.g. *Emaciaticeras*) are restricted to the upper Pliensbachian, while new, dominantly Toarcian groups appear already in the uppermost Pliensbachian (e.g. *Dactylioceras* aff. *pseudocommune*).

The ostracod fauna, indicating a continuous subsidence in the Middle Liassic, now shows a significant change which can be probably due to abrupt deepening of the bottom from sublittoral to bathyal depth. This is reflected by the phenomenon that the ostracod elements so characteristic to the sublittoral faunas in the Tenuicostatum Zone of Western Europe, are completely missing from the lowermost Toarcian beds in both Csernye sections.

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References

ANDREU, B., QUAJOUN, A. & CUBAYES, R. (1995): Ostracodes du Toarcien du Quercy (Bassin d'Aquitaine, France): systématique, biostratigraphie et paléobiogeographie. – Geobios, 28, pp. 209–240.

ARIAS, C. & LORD, A.R. (1999): Upper Pliensbachian and Lower Toarcian ostracoda from the Cordillera Iberica, North East Spain. – Revista Española de Micropaleontologia, 31, pp. 73–98, 219–242.

ARIAS, C. & WHATLEY, R. (2005): Paleozoogeography of Western European Lower Jurassic (Pliensbachian and Toarcian) Ostracoda. – Geobios, 38, pp. 697–724.

BÉCAUD, M. (2006): Les Harpoceratinae, Hildoceratinae et Paroniceratinae du Toarcien de la Vendée et des Deux-Sèvres (France) – Documents des Laboratoires de Gélogie, Lyon, 162, 1–153.

BODERGAT, A.-M. (1997): Les ostracodes marins de Jurassique européen. Utilisation stratigraphiques. – In: Group Français d'Étude du Jurassique: Biostratigraphie du Jurassique ouest-européen et méditerranéen: zonation parallèles et distribution des invertébrés et microfossiles. – CARIOU, E. & HANTZPERGUE, P. (coord.). – Bull. Centre Rech. Elf, Explor. Prod., Mém. 17, pp. 197–223.

BODERGAT, A.-M., BONNET, L., COLIN, J.P. & CUBAYES, J.R. (1998): Opportunistic development of *Ogmoconcha amalthei* (ostracod) in the Lower Liassic of Quercy (SW France): an indicator of sedimentary disturbance. – Palaeogeography, Palaeoclimatology, Palaeoecology, 143, pp. 179–190.

BOOMER, I. (1992): Lower Jurassic ostracods from Ilminster, Somerset, England. – Journal of Micropaleonotology, 11, pp. 47–57.

BOOMER, I., AINSWORTH, N.R. & EXTON, J. (1998): A re-examination of the Pliensbachian and Toarcian Ostracoda of Zambujal, west-central Portugal. – Journal of Micropaleontology, 17, pp. 1–14.

BRAGA, C. (1983): Ammonites del Domerense de la Zona Subbetica (Cordilleras Beticas sur de España) Tesis doctoral, Universidad de Granada, 410 p.

BUCKMAN, S.S. (1909–1930): Yorkshire Type Ammonites 1,2, and Type Ammonites 3–7, Wheldon & Wesley, London, 790 pls.

CANTALUPPI, G. (1972): Revisione di „*Grammoceras bassanii*" controversa specie-tipo dei generi d'Ammoniti *Protogrammoceras* e *Bassaniceras*. – Atti Soc. Sci. Nat. Mus. Civ. Storia nat. Milano, 113 (1972), pp. 335–356.

CATULLO, T.A. (1853): Intorno a una nuova classificazione delle Calcaire Rosse Ammonitiche delle Alpi Venete – Mem. Rel. Ist. Veneto, Sci., Lett. Arti, 5, pp. 1–57.

DOMMERGUES, J.-L-. MEISTER, C. & SCHIOLLI, P. (1997): Les successions des ammonites du Sinémurien supérieur au Toarcien basal dans les Préalpes de Brescia (Italie). – Memorie di Scienze Geologiche, 49, pp. 1–26.

FARAONI, P., MARINI, A., PALLINI, G. & VENTURI, F. (1994): Nuove faune ad ammoniti delle zone ad *E. mirabilis* ed *H. serpentinus* nella Valle del F. Bosso (PS) e loro riflessi sulla biostratigrafia del limite Domeriano-Toarciano in Appennino. Studi Geol., Cam., Vol. Spec., pp .247–297.

FISCHER, R. (1966): Die Dactylioceratidae (Ammonoidea) der Kammerer (Nordtirol) und die Zonengliederung des alpinen Toarcien. – Abhandlungen bay. Akad. Wiss, math. Nat. Kl., N.F., 126, pp. 1–83.

FUCINI, A. (1899–1900): Ammoniti del Lias medio dell'Appennino centrale esistensi nel Museo di Pisa – Palaeont. Ital., 5, pp. 145–185; 6, pp. 17–78.

FUCINI, A. (1920–1935): Fossili domeriani del dintorni di Taormina. – Paleont. Ital., 26/1920 (1923), pp. 75–116: pt. 1; 27/1921 (1924), pp. 1–21: pt. 2; 29–30/1923–1928 (1929), pp. 41–77: pt. 3; 31/1929–1930 (1931), pp. 93–149: pt. 4; 35/1934–1935 (1935), pp. 85–100: pt. 5.

FÜLÖP, J., GÉCZY, B., KONDA, J. & NAGY, E. (1969): Geological excursion in the Mecsek and Villány Hills and in the Transdanubian Central Range. – Hungarian Geological Institute, Budapest, 1–68 p.

GÉCZY, B. (1966): Ammonoides jurassiques de Csernye, Montagne Bakony, Hongrie – Part I. (Hammatoceratidae). – Geologica Hungarica, Series Palaeontologica, 34, pp. 1–276.

GÉCZY, B. (1967): Ammonoides jurassiques de Csernye, Montage Bakony, Hongrie – Part II.(excl. Hammatoceratidae). – Geologica Hungarica, Series Palaeontologica, 35, 1–413. Budapest.

GÉCZY, B. (1974): Biozones et chronozones dans le Jurassique de Csernye. – Colloque du Jurassique, Luxembourg, 1967. Mém. B.R.G.M.Fr. 75, pp. 411–422.

GÉCZY, B. & MEISTER, C. (1998): Les ammonites du Domérien de la montagne du Bakony (Hongrie). – Revue de Paléobiologie, Genève, 17/1, pp. 69–161.

GÉCZY, B. & MEISTER, C. (2007): Les ammonites du Sinémurien et du Pliensbachien inférieur de la montagne du Bakony (Hongrie). – Revue de Paléobiologie, Genève, 26/1, pp. 137–305.

HANTKEN, M. (1870): Geologische Untersuchungen im Bakonyer Wald. – Verhandlungen der k.-k. geologisches Reichsanstalt, 1, 4, pp. 58–59.

HARLOFF, J. (1994): Ostracoden aus dem Lias der Kalkalpen Bayerns und Nordtirols. – Stuttgarter Beiträge zur Naturkunde, Ser.B, 205, pp. 1–63.

JOLY, B. (2000): Les Juraphyllitidae, Phylloceratidae, Neophylloceratidae (Phyllocerataceae, Phylloceratina, Ammonoidea) de France au Jurassique et Crétacé. Geobios, Mém. Spéciel, 23, Mém. Soc. géol. France, N.S., 174, pp. 1–202.

KONDA, J. (1989): Magyrország geológiai alapszelvényei. Bakony, Isztimér (Bakonycsernye), Tűzköves-árok. Tűzkövesárki Mészkő Formáció. [Geological Reference Sections of Hungary. Tűzkövesárok Limestone Formation.] Hungarian Geological Institute, Budapest. 7 p.

KULCSÁR, K. (1914): Die mittelliassischen Bildungen des Gerecsegebirges. – Földtani Közlöny, 44/1, pp . 150–175.

LORD, A.R. (1974): Ostracods from the Domerian and Toarcian of England. – Palaeontology, 17/3, pp. 642–665.

LORD, A.R. (1988): Ostracoda of the Early Jurassic Tethyan Ocean. In: HANAI, T., IKEYA, N. & ISHIZAKI, K. (eds): Evolutionary Biology of Ostracoda. Kodansha/Elsevier, pp. 855–868.

LORD, A.R. & BOOMER, I.D. (1990): The occurrence of ostracods in the Triassic/Jurassic boundary interval. – Cahiers de l'Université Catholique de Lyon, Sér. Sci., 3, pp. 119–126.

MENEGHINI, G. (1867–1881): Monographie des fossiles du calcaire rouge ammonitique (Lias supérieur) de Lombardie et de l'Appenin central. – Paléontologie Lombarde, 242 pp.

MONOSTORI, M. (1995): Bajocian ostracods from the Som Hill (Bakony Mts, Hungary). – Hantkeniana, 1, pp. 155–161.

MONOSTORI, M. (1996): Pliensbachian ostracod fauna from condensed limestones of the Bakony Mts. (Transdanubain Central Range, Hungary): – Fragmenta Mineralogica et Palaeontologica, 18, pp. 33–61.

D'ORBIGNY, A. (1842–1851): Paléontologie française, Terrains jurassiques, 1, Cephalopodes. Masson, Paris, 642 p.

PRINZ, G. (1904): Die Fauna der älteren Jurabildungen im nordöstlichen Bakony. – Mitt. Jahrb. Ung. Geol. Anst., 15, pp. 1–142.

QUENSTEDT, F.A. (1845–1849): Petrefactenkunde Deutschkands; Die Cephalopoden. – L.F Fues, Tübingen, 580 p.

RIEGRAF, W. (1985): Mikrofauna, Biostratigraphie und Fazies im Unteren Toarcium Südwestdeutschlands und vergleiche mit benachbarten Gebieten. Tübinger mikropaläontologische Mitteilungen, 3, pp. 1–232.

VADÁSZ, M. (1910): Die Juraschichten des südlichen Bakony. – Resultaten der wissenschaftliche Erforschung des Balatonsees, Paläontologie, 1/1, pp. 1–89.

Plate 1

Fig. 1: *Zetoceras* cf. *zetes* (D'ORBIGNY, 1850); Section N, Bed C = Upper Pliensbachian. Wholly septate specimen.
Figs 2–3: *Phylloceras iuducariense* HAAS, 1913; Section A, Bed 69 = Upper Pliensbachian. Wholly septate specimen.

All photos natural size

Plate 1

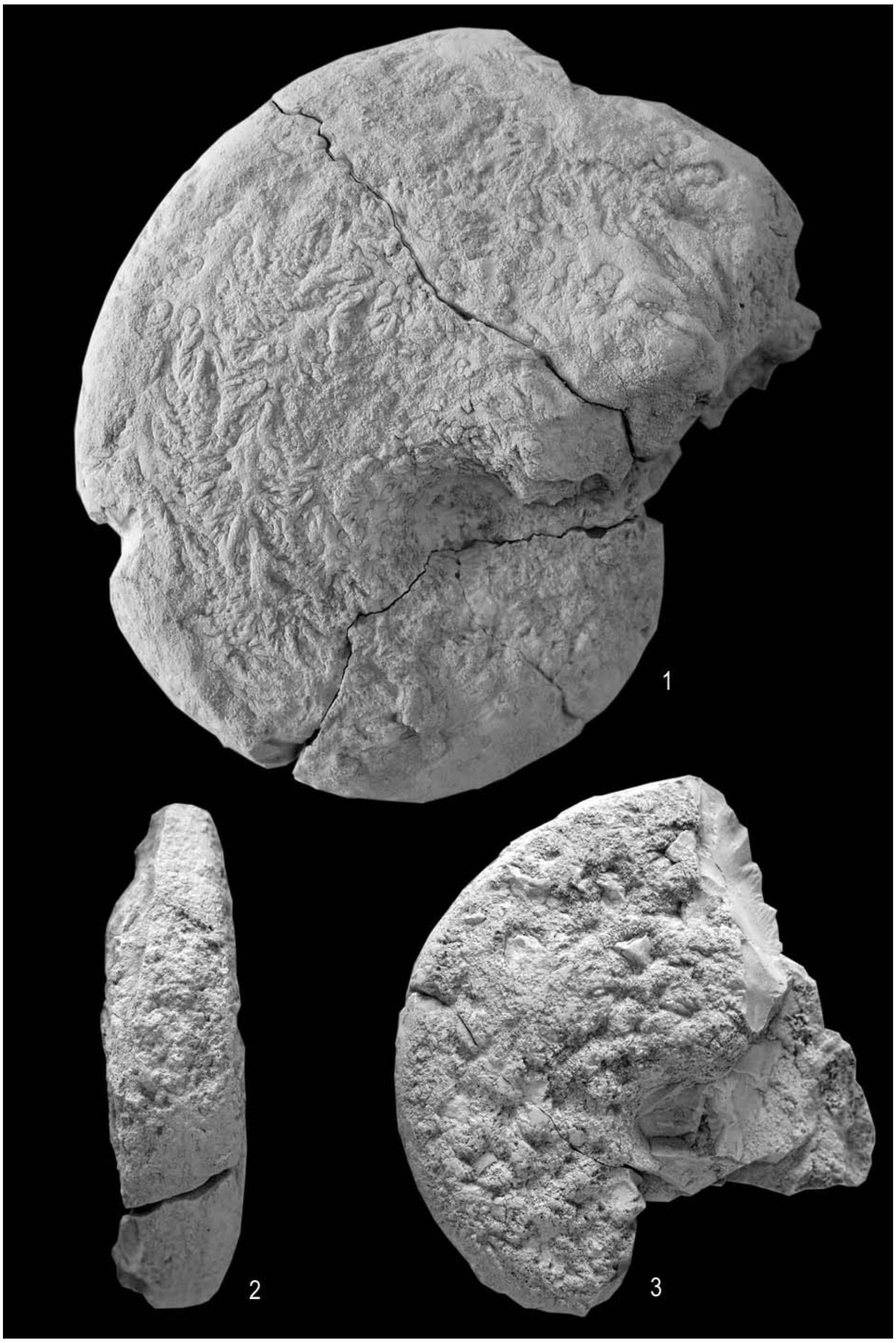

Plate 2

Fig. 1: *Partschiceras* sp.; Section A, Bed 69 = Upper Pliensbachian
Figs 2, 4–5: *Calliphylloceras* cf. *bicicolae* (MENEGHINI, 1874); Section N, Bed C = Upper Pliensbachian. Wholly septate specimens.
Fig. 3: *Lytoceras* cf. *baconicum* VADÁSZ, 1910; Section N, Bed C = Upper Pliensbachian. Wholly septate specimen.

All photos natural size

Plate 2

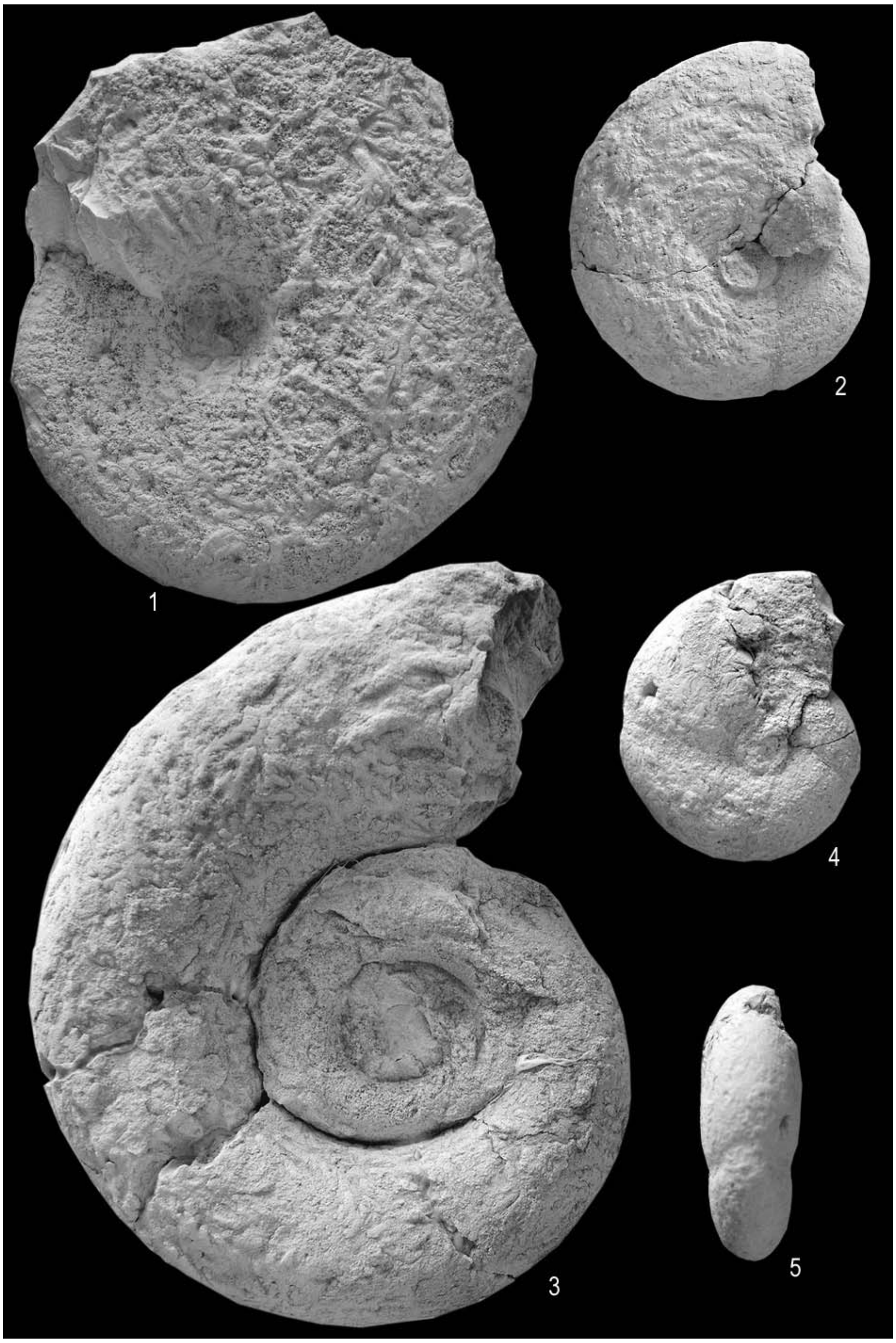

Plate 3

Figs 1–2: *Lytoceras* sp.; Section N, Bed E = basal Toarcian. Wholly septate specimen; X 0.8. Fig. 2 shows an enlarged part of the preserved portion of the sculptured shell.

Plate 3

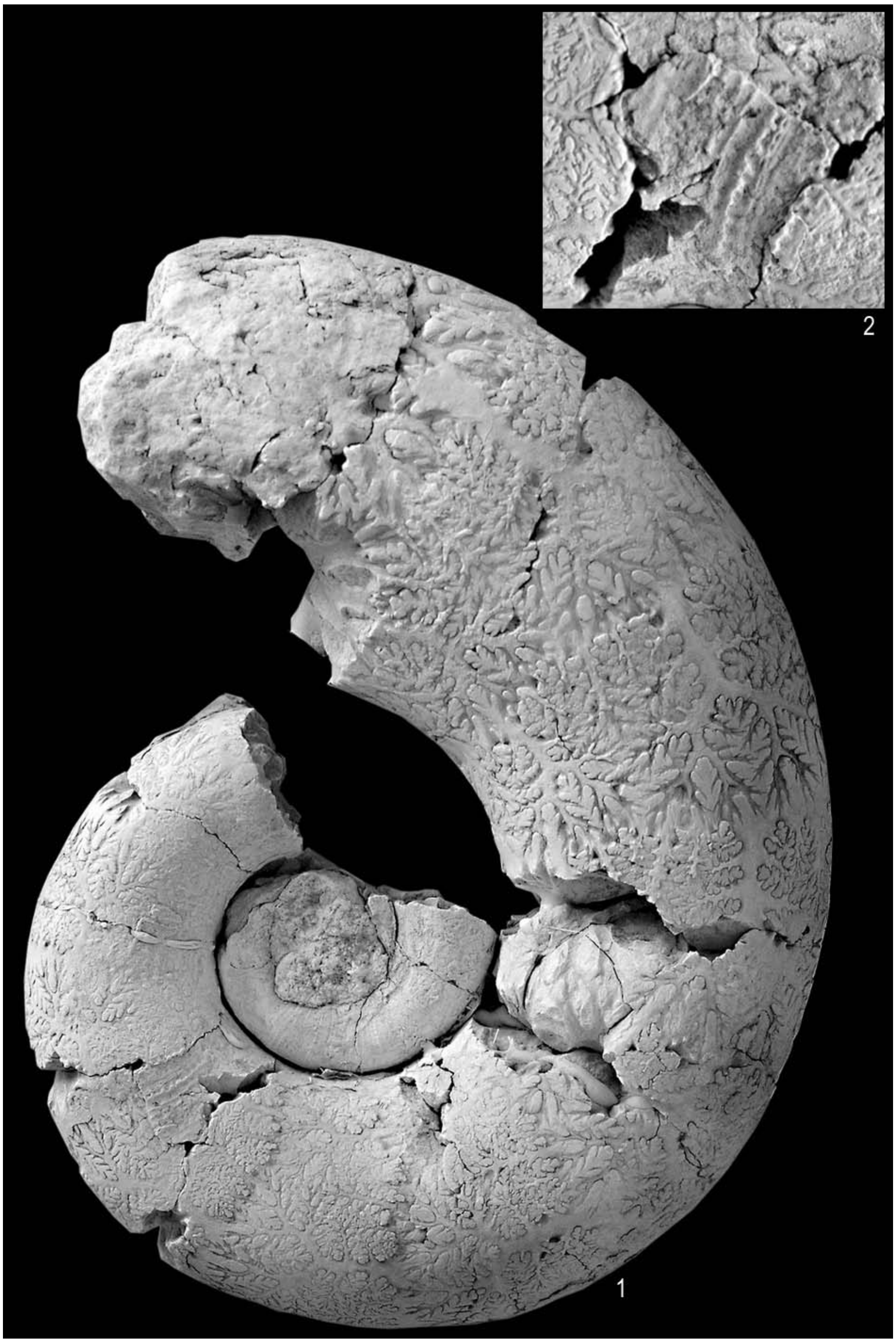

Plate 4

Fig. 1: *Emaciaticeras*? sp.; Section A, Bed 69 = Upper Pliensbachian. Wholly septate specimen.
Fig. 2: *Emaciaticeras* cf. *emaciatum* (CATULLO, 1853); Section A, Bed 69 = Upper Pliensbachian.
Figs 3–4: *Canavaria* cf. *ducetiana* FUCINI, 1931; Sectuin A, Bed 69 = Upper Sinemurian.

All photos natural size, asterisks indicate end of phragmocone.

Plate 4

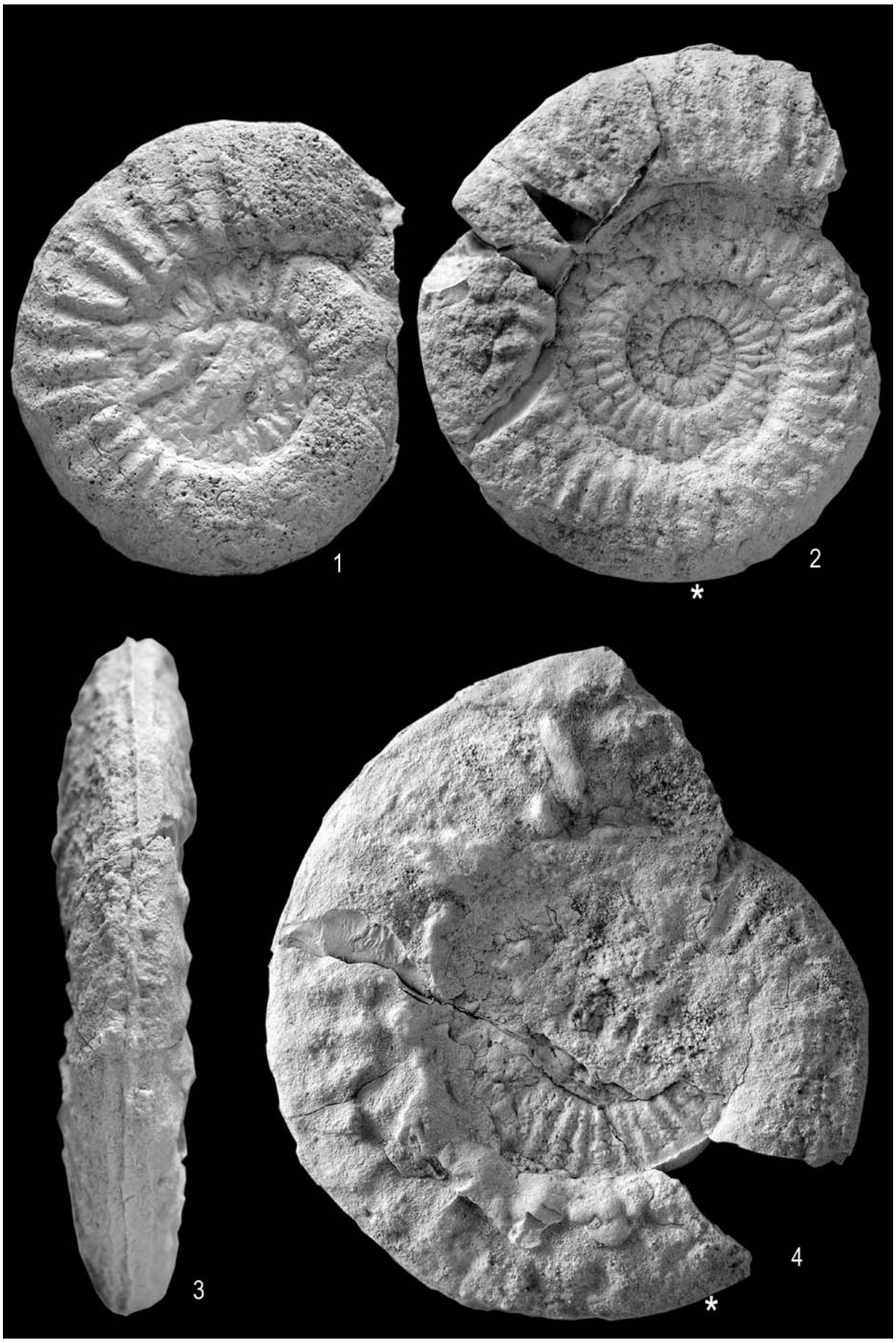

Plate 5

Figs 1–2: *Emaciaticeras emaciatum* (CATULLO, 1853); Section N, Bed A = Upper Sinemurian
Fig. 3: *Protogrammoceras* cf. *bassanii* (FUCINI, 1900); Section N, Bed C = Upper Sinemurian (for ventral view see Pl.6, fig.3)

All photos natural size, asterisks mark end of phragmocone.

Plate 5

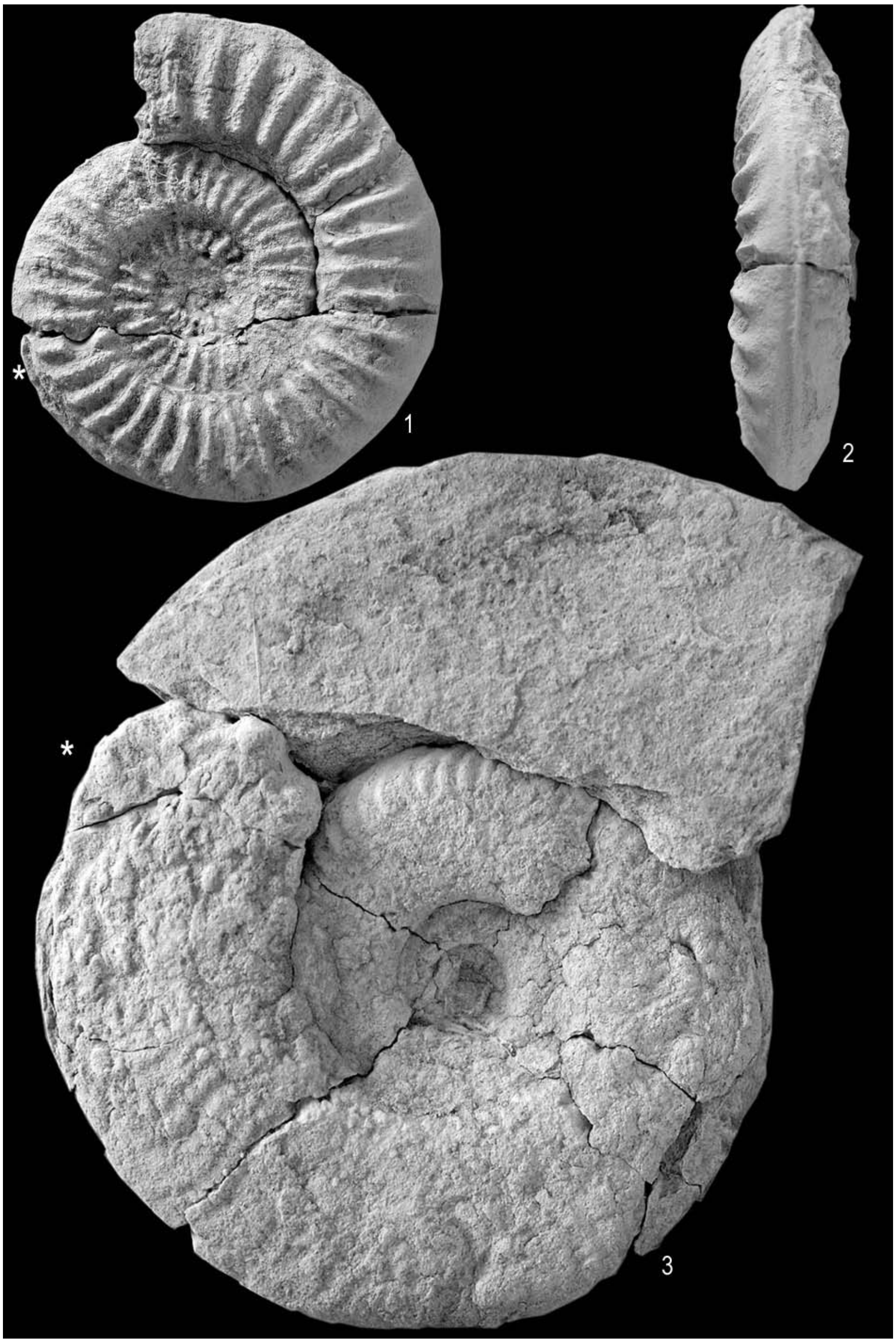

Plate 6

Fig. 1: *Canavaria* cf. *haugi* (GEMMELLARO, 1886); Section A, Bed 68 = Upper Pliensbachian
Fig. 2: *Lioceratoides* sp.; Section A, Bed 69 = Upper Sinemurian. Wholly septate specimen.
Fig. 3: *Protogrammoceras* cf. *bassanii* (FUCINI, 1900); Section N, Bed C = Upper Pliensbachian (see Pl.5, fig.3).
Fig. 4: *Fuciniceras* cf. *cornocalense* (TAUSCH, 1890); Section A, Bed 69 = Upper Pliensbachian.

All photos natural size, asterisks mark end of phragmocone.

Plate 6

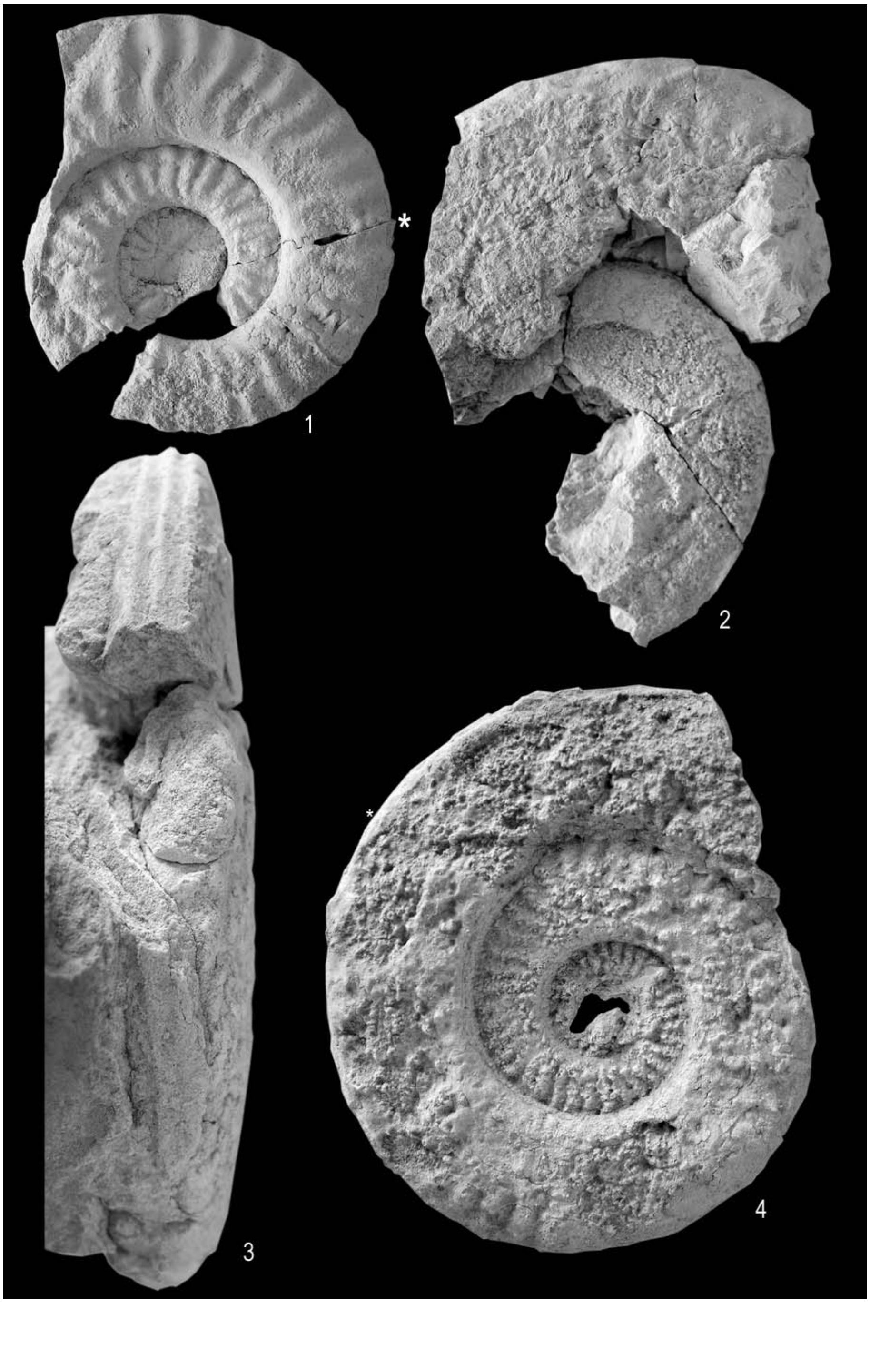

Plate 7

Figs 1–2: *Paltarpites* cf. *paltus* BUCKMAN, 1922; Section N, Bed E = Basal Toarcian. Wholly septate specimen.
Fig. 3: *Hildoceras* sp.; Section A, Bed 67 = Lower Toarcian
Fig 4: *Protogrammoceras* cf. *bassanii* (FUCINI, 1900); Section A, Bed 68 = Upper Pliensbachian. Wholly septate specimen.
Figs 5–6: *Hildaites crassus* (GUEX, 1973); Section A, Bed 67 = Lower Toarcian.

All photos natural size, asterisks mark end of phragmocone.

Plate 7

Plate 8

Figs 1–2: *Hildaites* cf. *forte* (BUCKMAN, 1921); Section A, Bed 67 = Lower Toarcian
Figs 3–4: *Hildoceras* sp. Section A, Bed 67 = Lower Toarcian
Figs 5–6: *Dactylioceras* sp. aff. *pseudocommune* FUCINI, 1935, Section A, Bed 69 = Upper Pliensbachian (previously figured by GÉCZY & MEISTER, 1998, pl. 7, fig. 1)

All photos natural size, asterisks mark end of phragmocone.

Plate 8

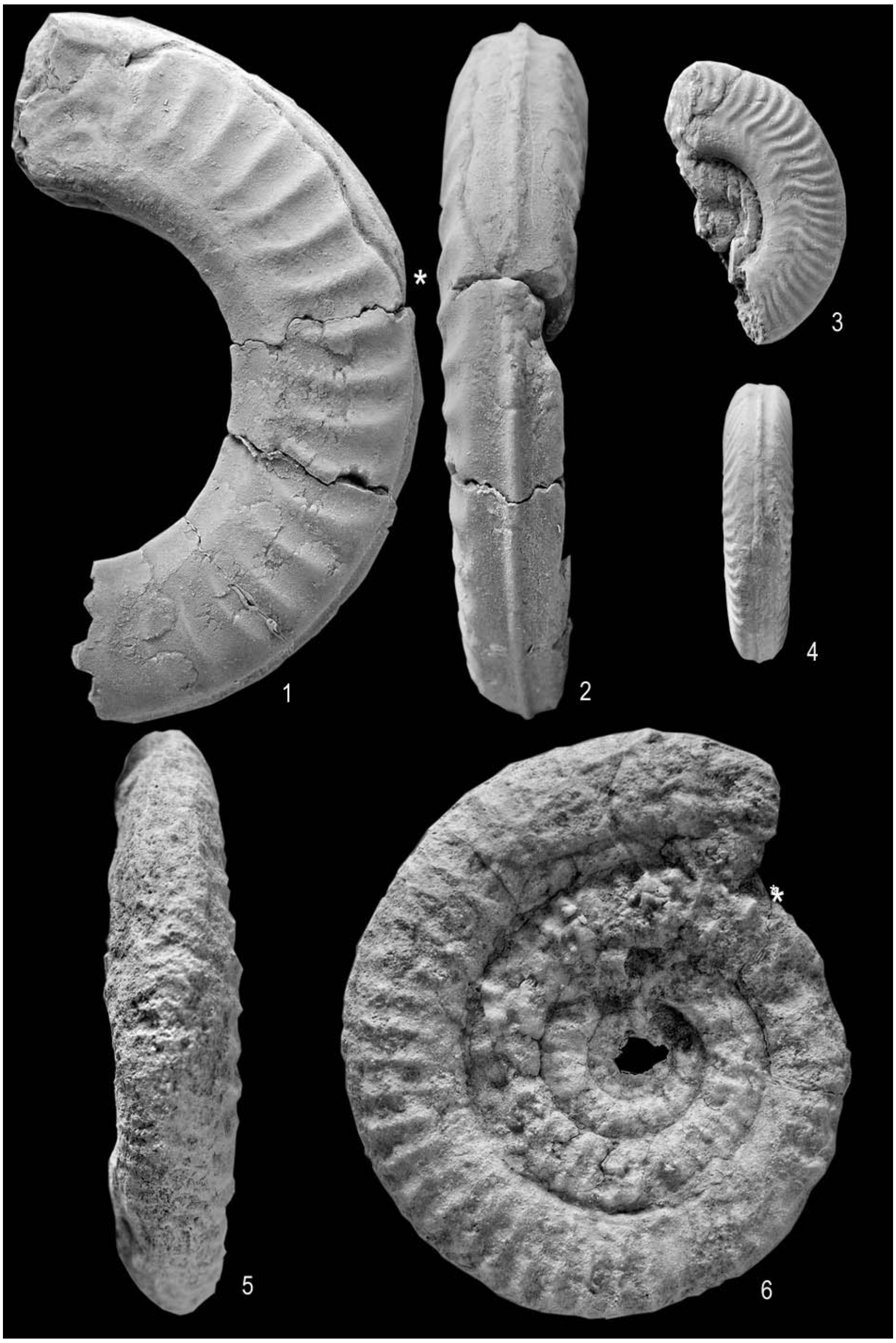

Plate 9

Fig.1. *Polycope*? sp.1. Carapace 90x. Section N, Bed C, Pliensbachian.
Fig.2. *Polycope* sp.2. Carapace 85x. Section A, Pliensbachian.
Fig.3. *Pseudohealdia acuticauda* MONOSTORI, 1966. Carapace from the right valve 80x. Section A, Pliensbachian.
Fig.4. *Ogmoconcha amalthei* (QUENSTEDT, 1858). Carapace from the right valve 60x. Section A, Pliensbachian.
Fig.5. *Ogmoconcha* sp. Carapace from the right valve 60x. Section N, Bed C, Pliensbachian
Fig.6. *Ogmoconchella*? sp. Carapace from the right valve 70x. Section A, Pliensbachian
Fig.7. *Cardobairdia liassica* (DREXLER, 1958). Carapace from the right valve 90x. Section A, Pliensbachian.
Fig.8. *Bairdia longoarcuata* Monostori, 1966. Carapace from the right valve 60x. Section N, Pliensbachian.

Plate 9

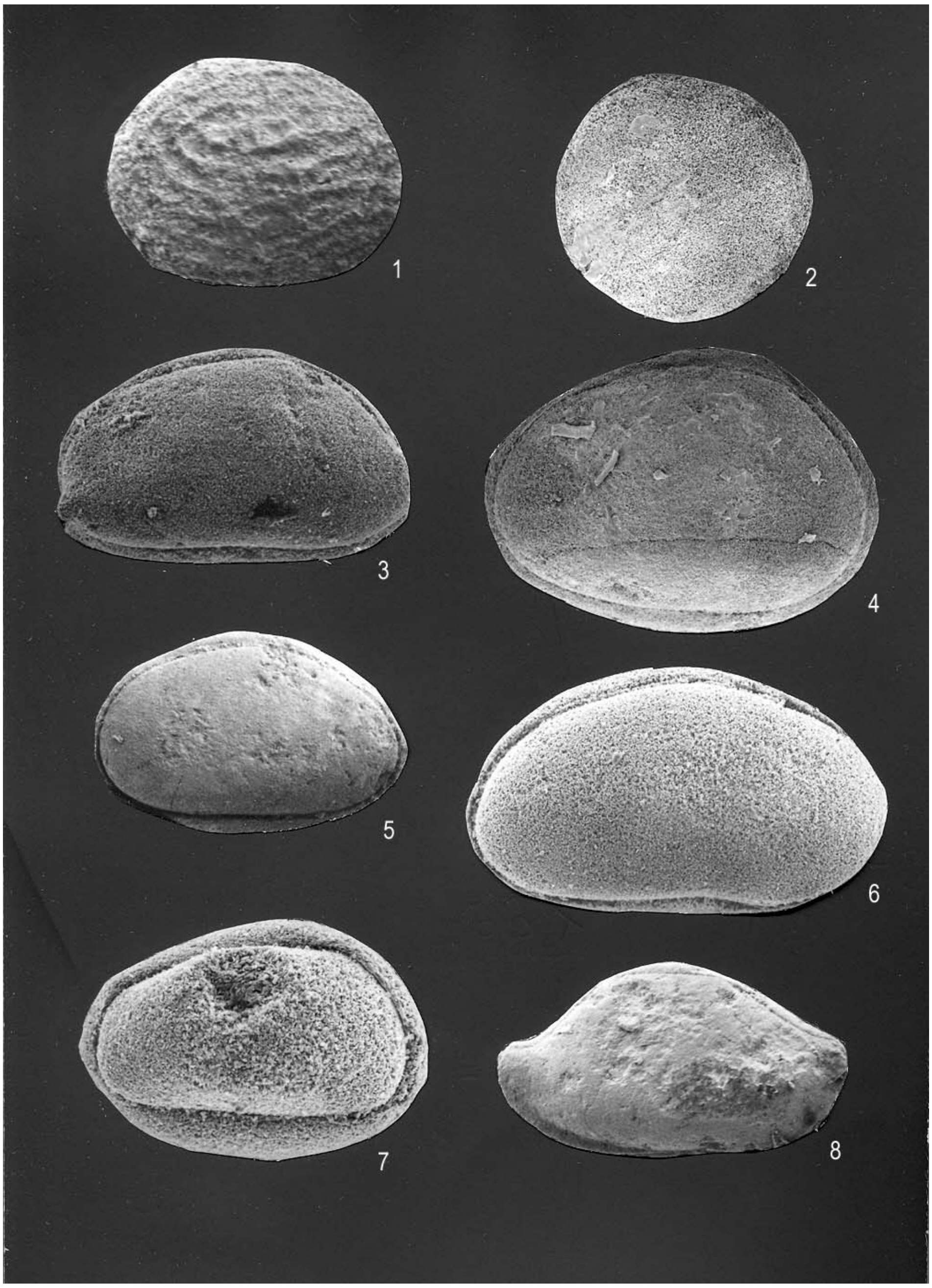

Plate 10

Fig.1. *Bairdia michelseni arcuatocauda* MONOSTORI, 1966. Carapace from the right valve 80x. Section A, Pliensbachian.
Fig.2. *Ptychobairdia lordi* MONOSTORI, 1996. Right valve 80x. Section A, Pliensbachian.
Fig.3. *Ptychobairdia* sp.1. Left valve 80x. Section A, Pliensbachian.
Fig.4. *Ptychobairdia* sp.2. Carapace from the right valve 70x. Section A, Pliensbachian.
Fig.5. *Ptychobairdia* sp.3. Carapace from the left valve 100x. Section N, Bed D, Pliensbachian.
Fig.6. *Lobobairdia rotundata* MONOSTORI, 1996. Left valve 65x. Section A, Pliensbachian.
Fig.7. *Lobobairdia rotundata* MONOSTORI, 1996. Right valve 50x. Section A, Pliensbachian.
Fig.8. *Macrocypris*? sp. Carapace from the right valve 70x. Section N, Bed D, Pliensbachian.

Plate 10

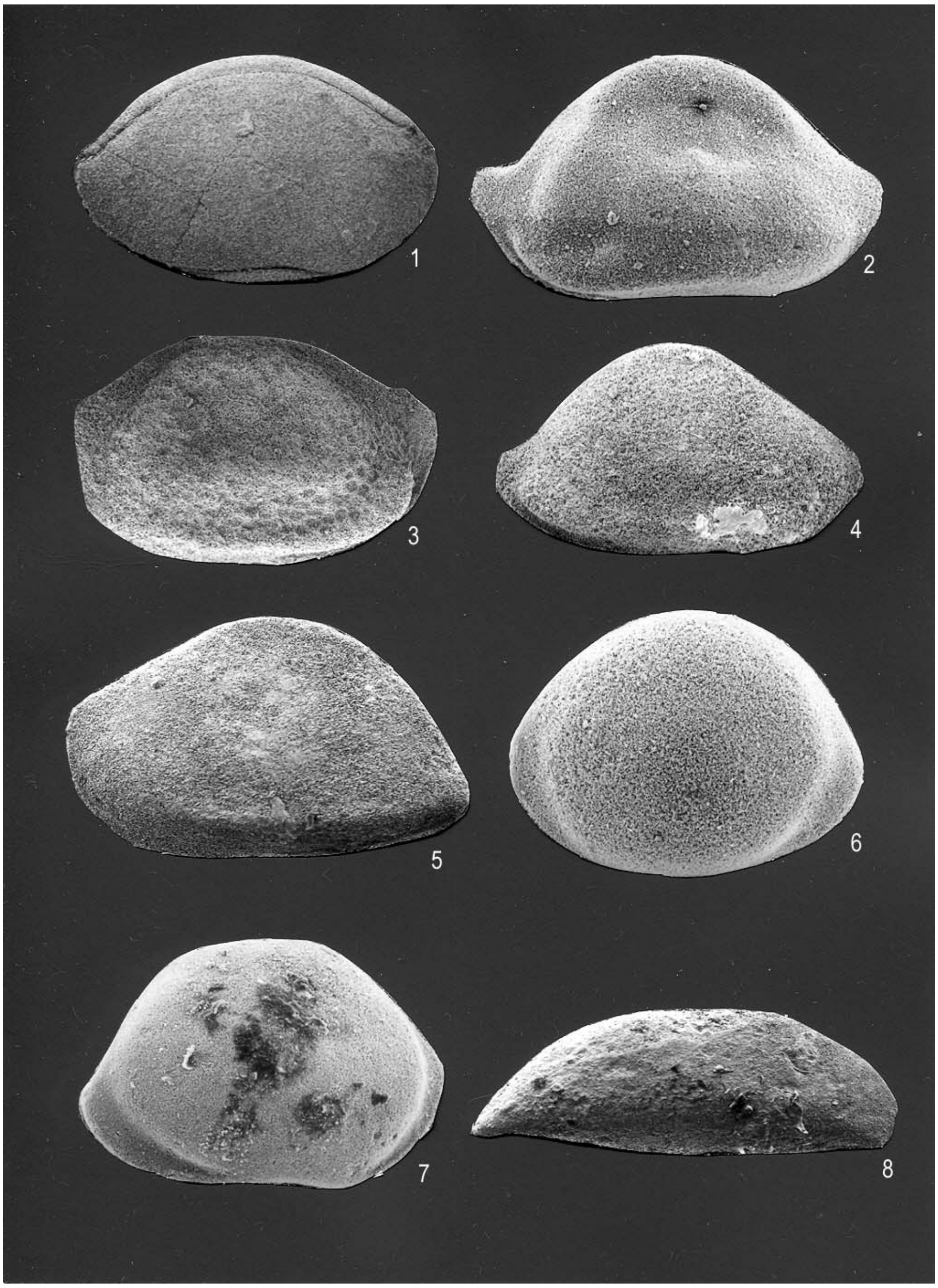

Plate 11

Fig.1. *Liasina lanceolata* APOSTOLESCU, 1959. Carapace from the right valve 90x. Section A, Pliensbachian.
Fig.2. *Fabalicypris*? sp. Carapace from the left valve 90x. Sectionh A, Pliensbachian.
Fig.3. *Paracypris redcarensis* BLAKE in BLAKE & TATE, 1876. Carapace from the right valve 75x. Section A, Pliensbachian.
Fig.4. *Paracypris* sp. Carapace from the right valve 75x. Section A, Pliensbachian.
Fig.5. *Isobythocypris*? *postera* HERRIG, 1979. Carapace from the right valve 65x. Section A, Pliensbachian.
Fig.6. *Cytherella* sp. Carapace from the left valve 67x. Section A, Toarcian.
Fig.7. *Cardobairdia* cf. *inflata spinosa* MONOSTORI, 1995. Carapace from the right valve 90x. Section N, Bed E, basal Toarcian.
Fig.8. *Cardobairdia* sp. Carapace from the right valve 90x. Section A, Toarcian.

Plate 11

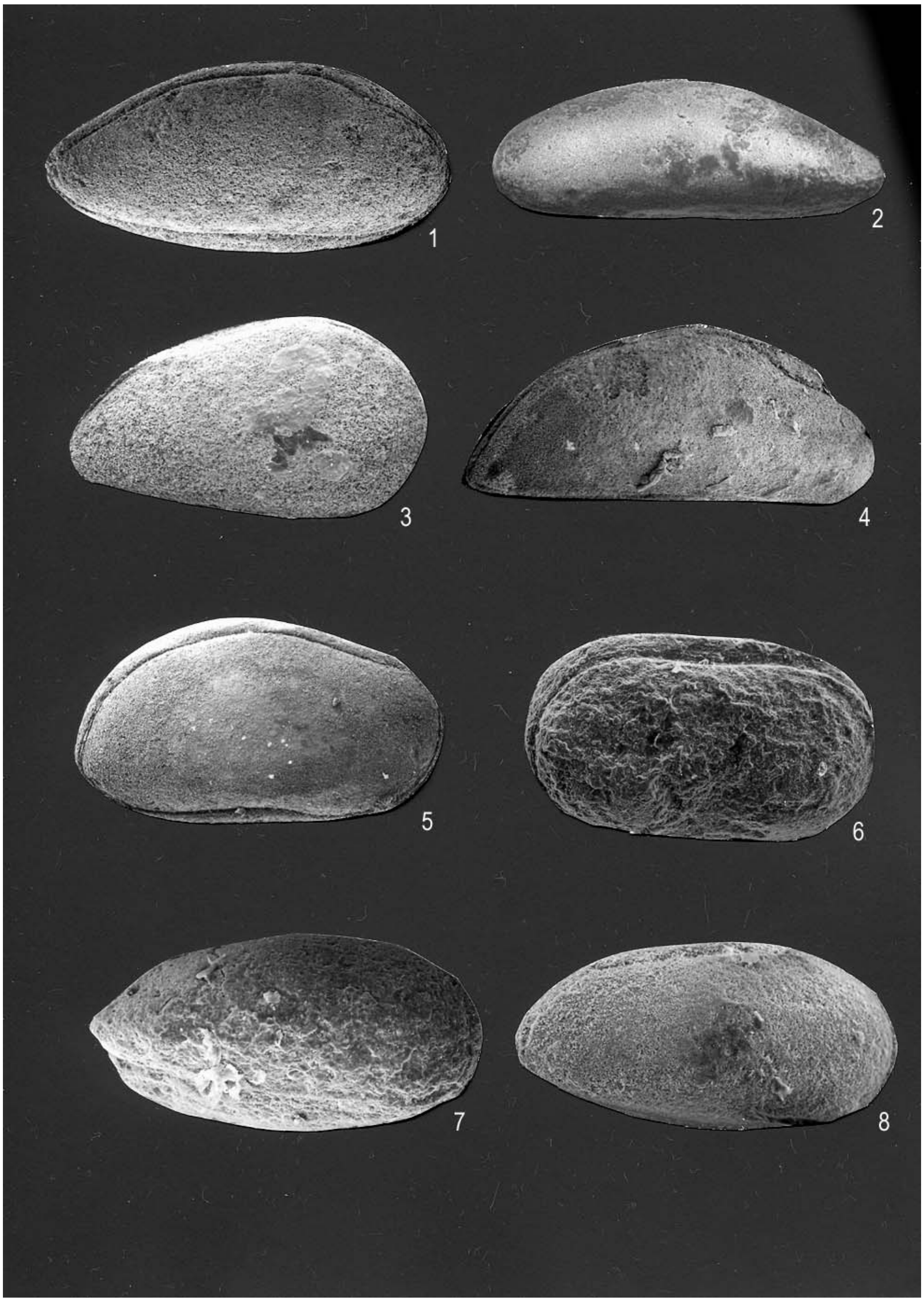

Plate 12

Fig.1. *Bairdia* cf. *guttulae* Herrig, 1979. Carapace form the left valve 55x. Section A, Toarcian.

Fig.2. *Bairdia michelseni arcuatocauda* MONOSTORI, 1996. Carapace from the right valve 70x. Section A, Toarcian.

Fig.3. *Bythocypris*? *faba* KNITTER, 1983. Carapace from the right valve 100x. Section N, Bed E, basal Toarcian.

Fig.4. *Bythocypris*? *faba* KNITTER, 1983. Carapace from the right valve 80x. Section A, Toarcian.

Fig.5. *Pontocyprella* cf. *cavata* MONOSTORI, 1995. Carapace from the right valve 70x. Section A, Toarcian.

Plate 12