Геолошки анали Балканског полуострва Annales Géologiques de la Péninsule Balkanique	66 (2004–2005)	55–61	Београд, децембар 2005 Belgrade, December 2005

Microfossils and brachiopods from the Lower Barremian at Prekonozi, eastern Serbia

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Abstract. This paper presents the results of an integral biostratigraphical study based on orbitolinids and other benthic foraminifers, brachiopods and algae of a part of the Prekonozi section, eastern Serbia. The species identified are: *Paracoskinolina*? *jourdanensis* Foury & Moullade, *P. sunnilandensis* (Maync), *Orbitolinopsis debelmasi* Moullade & Thieuloy, *Alpillina antiqua* Foury, *Pfenderina globosa* Foury, *Mayncina bulgarica* Leug, Peibernès & Rey, *Charentia cuvilleri* Neumani and other foraminifers, and brachiopods: *Cyclothyris*? *pancici* (Antula), *Sellithyris sella* (J. de C. Sowerby), *Dictyothyris elongata* Smirnova, and *Psilothyris tamarindus* (J. de C. Sowerby). The examined limestones based on orbitolinids, are assigned to the Lower Barremian, earlier dated Upper Barremian/Lower Aptian.

Key words: Orbitolinids, brachiopods, biostratigraphy, Lower Barremian, Prekonozi, eastern Serbia.

Апстракт. Приказују се резултати интегралних биостратиграфских проучавања једног дела профила Преконога (источна Србија) на основу орбитолинида и других бентоских фораминифера, брахиопода и алги. Одређене су: *Paracoskinolina*? *jourdanensis* Foury & Moullade, *P. sunnilandensis* (Maync), *Orbitolinopsis debelmasi* Moullade & Thieuloy, *Alpillina antiqua* Foury, *Pfenderina globosa* Foury, *Mayncina bulgarica* Leug, Peibernès & Rey, *Charentia cuvilleri* Neumann и други фораминифери, а од брахиопода: *Cyclothyris*? *pancici* (Antula), *Sellithyris sella* (J. de C. Sowerby), *Dictyothyris elongata* Smirnova и *Psilothyris tamarindus* (J. de C. Sowerby). На основу орбитолинидске фауне проучавани кречњаци се приписују доњем барему, а до сада се сматрало да су горњобаремске–доњоаптске старости.

Кључне речи: орбитолиниди, брахиоподи, биостратиграфија, доњи барем, Преконози, источна Србија.

Introduction

Lower Cretaceous sedimentary rocks exposed on the southern slopes of Ozren (Prekonozi), south of Sokobanja, belong to the western belt of the Carpatho-Balkanides, eastern Serbia.

The Lower Cretaceous of Ozren, in the northern part of Prekonozi syncline, lies continuously over Jurassic limestones and consists of: Valanginian/Hauterivian shallow-water limestones, Barremian and Aptian rocks, represented by shallow-water limestones of the Urgonian facies (Krstić, 1977; Krstić *et al*., 1978, 1980).

The results of the presented examination agree with the stratigraphical data of the latest integral study by a group of authors from several European countries (Clavel *et al*., 2002).

This work presents information on a part of a Lower Cretaceous sequence that has been dated Upper Barremian/Lower Aptian (Krstić *et al*., 1978, 1980), which is now interpreted using orbitolinids as Lower Barremian (Polavder, 2004).

Within the study of the Lower Cretaceous biostratigraphy based on microfossils, orbitolinids in particular, brachiopods were also collected in the area between Sokobanja and Niš and interpreted in this paper by B. Radulović.

Biostratigraphy

In a partly exposed Lower Cretaceous succession near Prekonozi, Polavder (2004) designated three biosequences:

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– Biosequence C, Berriasian in age, represented by shallow-water foraminiferal and algal limestones (upper part of the Berriasian column);

– Biosequence E, Upper Hauterivian in age, designated on the abundant orbitolinids, among which the most important is *Valserina primitiva* SCHROEDER, CHAROLAIS & CONRAD – the stratigraphical marker of the Upper Hauterivian;

– Biosequence F, Lower Barremian in age, designated on the orbitolinid species that appear in the Lower Barremian and those which disappear in the Lower Barremian.

We studied the Lower Barremian sequence in a section, about 25 m thick, exposed along the road from Prekonozi to Rsovci (Fig. 1). These are dominantly bioclastic, more or less muddy limestones of the packstone-floatstone-rudstone type. Layers of the sequence contain in places numerous orbitolinids, especially at the base of the section, and other foraminifers, appreciable amounts of algae, algal fragments, bryozoans, microgastropods and other metazoans, and brachiopods in one of the layers.

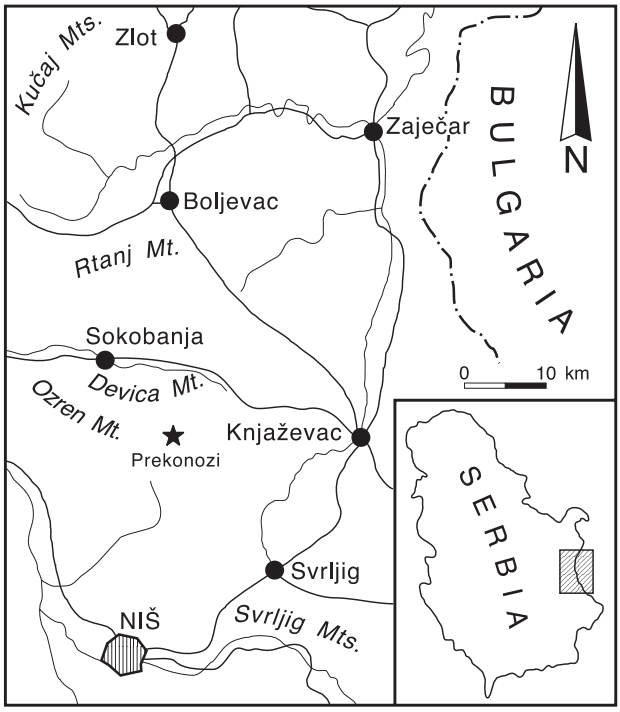

Fig. 1. Location map of the studied area (asterisk).

Over the Upper Hauterivian shallow-water limestones (layers with *Valserina primitiva*) upward follow:

– About five metres of muddy biolithoclastic limestones abounding in microfossils, orbitolinids in particular, of which are identified: *Alpillina antiqua* FOURY (Pl. 1, Figs. 1, 2), *Orbitolinopsis debelmasi* MOULLADE & THIEULOY (Pl. 1, Figs. 4, 5), *O*. gr. *buccifer* ARNAUD-VANNEAU & THIEULOY (Pl. 1, Fig. 3), *Paracoskinolina*? *jourdanensis* FOURY & MOULLADE, *Paracoskinolina sunnilandensis* (MAYNC), *Valserina* sp., *Pfenderina globosa** FOURY (Pl. 1, Fig. 8), *Mayncina bulgarica* LEUG, PEYBERNÈS & REY, *Charentia cuvilleri* NEUMANN, *Nautiloculina cretacea* PEYBERNÈS, *Pseudocyclammina* cf. *lituus* (YOKOYAMA), *Pseudolituonella gavonensis** FOURY (Pl. 1, Fig. 7), *Everticyclammina* sp., *Ammobaculites** sp., trocholinae, miliolids and other foraminifers, then algae: *Clypeina estevezii* GRANIER (Pl. 1, Fig. 9), *Macroporella platurloni* DRAGASTAN, *Salpingoporella* sp., *Neomeris* sp., *Terqumella sp*., fragments of *Pseudocymopolia jurassica* (DRAGASTAN) and fragments of other species.

– Two metres of sandy, incoherent bioclastic limestones which bears numerous brachiopods: *Cyclothyris*? *pancici* (ANTULA), *Sellithyris sella* (J. DE C. SOWERBY), *Dictyothyris elongata* SMIRNOVA, and *Psilothyris tamarindus* (J. DE C. SOWERBY). Compared with the older layers of the sequence, limestones with brachiopods are much poorer in microfossils, particularly orbitolinids (only a few indeterminate sections). In addition to foraminiferal species (marked by an asterisk in the list above) the rocks contain: *Earlandia*? *conradi* ARNAUD-VANNEAU, *Neotrocholina friburgensis* GUILLUME & REICHEL, *Trocholina alpina* (LEUPOLD) and other trocholinae, and the mentioned dasycladales species.

– Other bioclastic limestones (about eighteen metres) in this part of the section mainly bear a similar microfossil assemblage as the older brachiopod layers. An important find is the orbitolinid species *P*.? *jourdanensis,* which appears some three metres above the brachiopod-bearing layers and can be traced to the end of the section, and most probably a new orbitonilid species – *Orbitolinid* gen. et sp. indet. (Pl. 1, Fig. 6).

Above these limestones, sandstone and marl-sandy deposits devoid of faunal remains occur.

This investigated sequence, according to the orbitolinid assemblage, is certainly Lower Barremian in age. The mentioned foraminiferal and algal association has a wider biostratigraphic significance. The lower boundary is placed where the foraminiferal assemblage characteristic of the Upper Hauterivian (beds with *Valserina primitiva*) disappears and where the orbitolinid species characteristic of the Lower Barremian appear. The species only within the Lower Barremian (*A. antiqua*) and those disappearing in the Lower Barremian (*O. debelmasi, P*.? *jourdanensis*) give the rocks their principal biostratigraphic character. As the newest sampled rocks in the column contain *P*.? *jourdanensis*, this part of the sequence is Lower Barremian. This latter species in sedimentary rocks younger than the Lower Barremian is not mentioned anywhere in the recent voluminous literature on the Lower Cretaceous stratigraphy (ARNAUD-VANNEAU, 1980; BUCUR *et al*., 1995; BUCUR, 1997; BECKER, 1999; DAOUD *et al*., 2004).

Brachiopods

The Brachiopods described in this paper are from the part of the sequence composed dominatly of bioclastic

packstone and very fine silty and clayey limestone and less of grainstone.

Because the brachiopod association has a greater range, the age of this part of the sequence is determined as Lower Barremian on the basis of the orbitolinid microassocation.

The brachiopod species determined are: *Cyclothyris*? *pancici* (ANTULA), *Sellithyris sella* (J. DE C. SOWERBY), *Dictyothyris elongata* (SMIRNOVA) and *Psilothyris tamarindus* (J. DE C. SOWERBY).

Except *C.*? *pancici*, which is known from the Upper Barremian, all the other species have a vertical distribution, from Valanginian to Lower Aptian, and are also known from many localities (Crnoljevica, Čoka Njalta, Faca Vajali, Mali Izvor) of eastern Serbia.

simple subtriangular costae, 6–8 on fold, 5–7 in sulcus. Fold and sulcus barely perceptible.

The shell is composed of two calcitic layers (Fig. 3A, B). The primary layer is microgranular, 20 μm thick in the sulci and 30 μm in the ribs. The secondary layer is built up of isometric rhombic fibres (W = 35–45 μm; T = 8–12 μm).

The external features as well as the shell ultrastructure (shape and dimensions of the fibres) indicate that the specimens belong to a new genus (RADULOVIĆ, 2005), a detailed systematic description of which will soon be published.

It is very common in the Barremian throughout eastern Serbia (RADULOVIĆ, 2000, 2003).

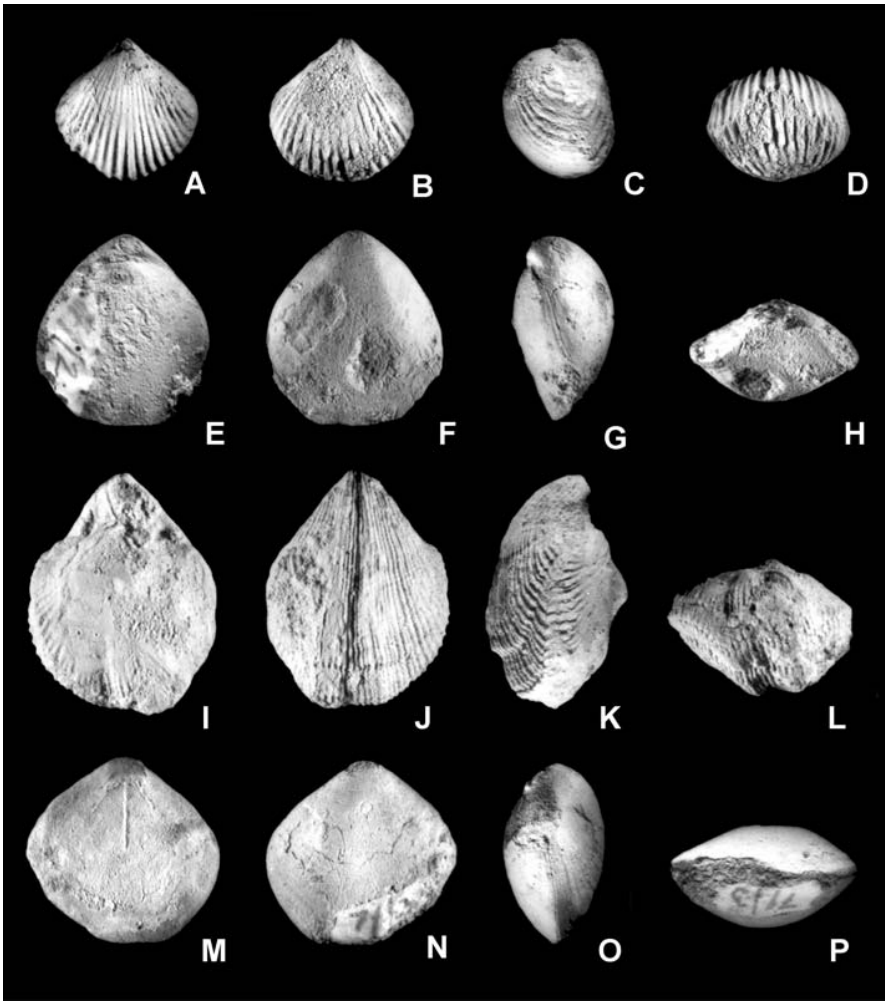

Fig. 2. Lower Baremmian brachiopods from Prekonozi, Ozren Mt., eastern Serbia: **A–D**. *Cyclothyris*? *pancici* (ANTULA, 1903), RGF BR 71/7; **E–H**. *Sellithyris sella* (J. DE C. SOWERBY, 1823), RGF BR 71/8; **I–L**. *Dictyothyris elongata* SMIRNOVA, 1969, RGF BR 71/9; **M–P**. *Psilothyris tamarindus* (J. DE C. SOWERBY 1836), RGF BR 71/10. All specimens in dorsal, ventral, lateral and anterior views; × 1.9.

***Cyclothyris*? *pancici* (ANTULA, 1903)** (Fig. 2A–D). Shell small sized (L_{max}= 10.8 mm), nearly as long as wide, spherical, strongly dorsibiconvex, roundly triangular in outline. Maximum width and thickness situated at about mid-length. Beak strong, pointed, and suberect. Beak ridges very distinct, delimiting a quite wide concave interarea. Hypothyrid foramen small, circular, slightly auriculate. Anterior commissure highly and roundly uniplicate. Each valve ornamented with 26–28

***Sellithyris sella* (J. DE C. SOWERBY, 1823)** (Fig. 2E–H). Medium-sized shell (L = 14.1, W = 12.8, T = 7.8 mm), elongated rounded-pentagonal in outline, moderately and nearly equally biconvex. Maximum width at midvalve, maximum thickness in posterior third. Beak suberect with a mesothyrid subcircular foramen of medium size. Beak ridges subangular, short. Symphitium partly hidden. Lateral commissure oblique; anterior commissure biplicate. Shell little-folded.

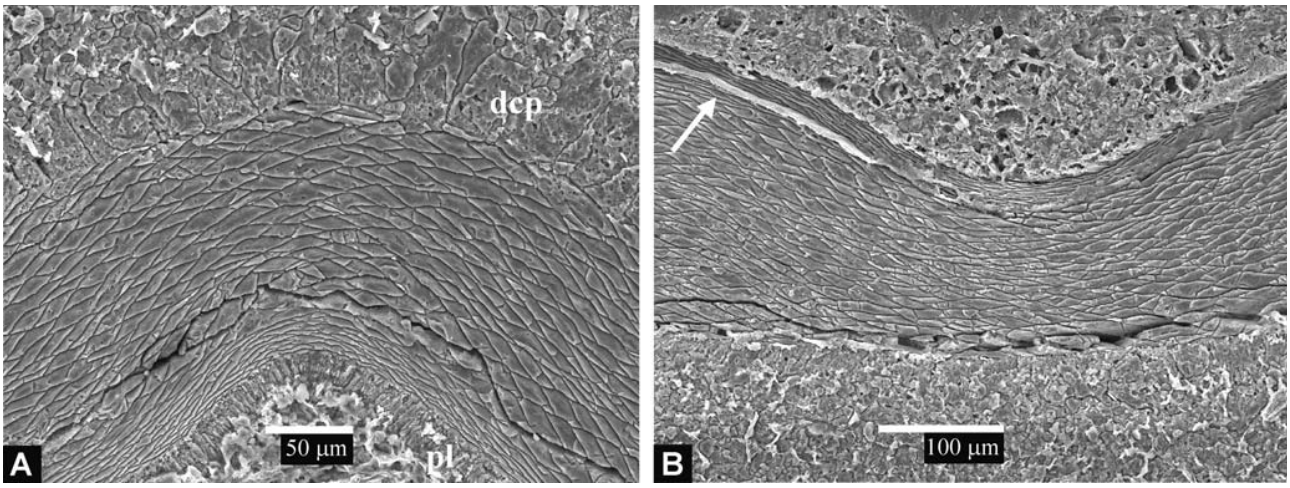

Fig. 3. *Cyclothyris*? *pancici* (ANTULA), Lower Baremmian, Prekonozi, Ozren Mt., eastern Serbia. SEM micrographs of transverse sections of the shells. **A**. Sulcus of dorsal valve, primary microgranular layer (pl) below, secondary layer with finer fibrous sublayer, overgrown by diagenetic calcite prisms (dcp); specimen RGF BR 71/2. **B**. Sulcus and two ribs of ventral valve, secondary layer with sublayer of finer fibres in the outermost part of the shell, silicified organic sheet (arrow), primary layer missing; specimen RGF BR 71/2.

Sellithyris sella is first known from the uppermost Valanginian of the Jura region, Northern Caucasus and Mangyshalk. It becomes widespread in the Hauterivian and much less abundant in the Barremian of Europe. The species reached its acme in the Lower Aptian. In eastern Serbia, *S. sella* sporadically occurred in the Lower Barremian of Prekonozi and the Upper Barremian of Crnoljevica (RADULOVIĆ, 2000); in the Lower Aptian of Faca Vajali (RADULOVIĆ, 2003) it reached its maximum development.

***Dictyothyris elongata* SMIRNOVA, 1968** (Fig. 2I–L). Shell medium sized (L = 17.3, W = 13.4, T = 10.2 mm), roundly pentagonal in outline, anterior margin truncated, moderately ventribiconvex. Maximum width and convexity situated at mid-length. Lateral commissure gently arched ventrally; anterior commissure W-shaped. Umbo nearly straight, high and pointed with large, circular, mesothyrid foramen. Beak ridges rounded. Interarea large, slightly concave. Ventral sulcus rounded and shallow, starting from the umbo, widening toward the anterior margin, separated by rounded folds from flanks. Corresponding dorsal fold rounded, extending from the dorsal umbo to the anterior margin, laterally bounded by shallow rounded sulci.

Ornamentation of fine rounded ribs increasing by intercalation, numbering about 60 at the anterior margin, separated by rounded interspaces as wide as ribs. Shell surface densely punctate.

The species was originally described by SMIRNOVA (1968) from the Lower Hauterivian of Northern Caucasus. In eastern Serbia it is found in the Lower Barremian, so its stratigraphical distribution is extended

***Psilothyris tamarindus* (J. DE C. SOWERBY, 1836)** (Fig. 2M–P). Shell of medium size (L = 13.8, W = 14.3, T = 7.8 mm), rounded pentagonal outline, width greater than length, equally moderately biconvex. Maximum width and thickness at mid-length. Beak erect, low and wide with small circular mesothyrid foramen. Sharp beak ridges border wide and recessed interarea. Anterior commissure slightly uniplicate. Median septum 0.40 of the dorsal valve length.

The external, internal and ultrastructural features of this species were recently described in detail by RADULOVIĆ & RADULOVIĆ (2002) from the Lower Aptian of Faca Vajali, Kučaj Mt., eastern Serbia.

Conclusion

A part of the Lower Cretaceous series, in Prekonozi section, earlier considered Upper Barremian/Lower Aptian is presently assigned to the Lower Barremian. This age is determined using the orbitolinid species *Alpillina antiqua* FOURY which appears only in the Lower Barremian, and those which disappear in the Lower Barremian: *Orbitolinopsis debelmasi* MOULLADE & THIEULOY and *Paracoskinolina*? *jourdanensis* FOURY & MOULLADE.

Layers bearing brachiopods: *Cyclothyris*? *pancici* (ANTULA), *Sellithyris sella* (J. DE C. SOWERBY), *Dictyothyris elongata* (SMIRNOVA) and *Psilothyris tamarindus* (J. DE C. SOWERBY) have a broader biostratigraphic significance, determined on orbitolinids also as Lower Barremian.

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Резиме

Микрофосили и брахиоподи из доњег барема Преконога, источна Србија

Доњокредни седименти откривени на јужним падинама Озрена (Преконози), јужно од Сокобање, припадају западном појасу Карпато–балканида источне Србије.

Доња креда Озрена, у јужном делу Преконошке синклинале, континуирано лежи преко јурских карбоната, а чине је: плитководни кречњаци валендис–отрива, као и баремски и аптски седименти представљени плитководним кречњацима ургонске фације (КРСТИЋ, 1977; KRSTIĆ i dr., 1978, 1980). Резултати садашњих проучавања у сагласности су са стратиграфским резултатима најновијих интегралних проучавања до којих је дошла група аутора из више европких земаља (CLAVEL *et al*., 2002).

Наша проучавања односе се на део доњокредног стуба, у профилу Преконози, који је до сада сматран искључиво горњобаремским–доњоаптским, а сада се, на основу орбитолинидских врста, приписује доњем барему. То су, претежно, биокластични, више или мање муљевити кречњаци типа пекстон–флотстон–радстон. Слојеви ове секвенце садрже орбитолиниде, нарочито у базалном делу профила, уз које се јављају и други фораминифери, алге, фрагменати алги, бриозое, микрогастроподи и други метазои. У једном од тих слојева нађена је и брахиоподска фауна: *Cyclothyris*? *pancici* (ANTULA), *Sellithyris sella* (J. DE C. SOWERBY), *Dictyothyris elongata* SMIRNOVA и *Psilothyris tamarindus* (J. DE C. SOWERBY). Констатоване су, местимично бројне, орбитолиниде: *Alpillina antiqua* FOURY, *Orbitolinopsis debelmasi* MOULLADE & THIEULOY, *O*. gr. *buccifer* ARNAUD-VANNEAU & THIEULOY, *Paracoskinolina*? *jourdanensis* FOURY & MOULLADE, *P. sunnilandensis* (MAYNC), *Valserina* sp., и друге фораминифере: *Pfenderina globosa* FOURY, *Mayncina bulgarica* LEUG, PEYBERNÈS & REY, *Charentia cuvillieri* NEUMANN, *Nautiloculina cretacea* PEYBERNÈS, *Pseudocyclammina* cf. *lituus* (YOKOYAMA), *Pseudolituonella gavonensis* FOURY, *Earlandia*? *conradi* ARNAUD-VANNEAU, *Neotrocholina friburgensis* GUILLUME & REICHEL, *Trocholina alpina* (LEUPOLD), *Everticyclammina* sp., *Ammobaculites* sp., трохолине, милиолиде, затим алге: *Clypeina estevezii* GRANIER, *Rajkaella subtilis* DRAGASTAN, *Actinoporella podolica* (ALTH), *Macroporella platurloni* DRAGASTAN, *Salpingoporella* sp., *Neomeris* sp., *Terqumella* sp., фрагменти *Pseudocymopolia jurassica* (DRAGASTAN) као и фрагменти других врста.

Овај део анализиране секвенце, на основу асоцијације орбитолинида, је несумљиво доњобаремске старости. Већина фораминифера, алги као и брахиоподска асоцијација има шири биостратиграфски значај. Доња граница одређена је на основу нестанка фораминиферске заједнице карактеристичне за горњи отрив (слојеви са *Valserina primitiva*), а

појавом орбитолинидских врста карактеристичних за доњи барем. Основно биостратиграфско обележје дају врсте које су ограничене само на доњи барем (*A. antiqua*), као и оне које ишчезавају у доњем барему (*O. debelmasi*, *P.*? *jourdanensis*). Како најмлађе опробавани седименти испитиваног стуба садрже врсту *P.*? *jourdanensis* старост овог дела испитиване секвенце је доњобаремска. У врло обимној, новијој литератури о стратиграфији доње креде, *P.*? *jourdanensis* није позната у седиментима млађим од доњег барема (ARNAUD-VANNEAU, 1980; BUCUR *et al.*, 1995; BUCUR, 1997; BECKER, 1999; DAOUD *et al.*, 2004), па се може закључити да је проучавана серија доњобаремске старости.

PLATE 1

Figs. 1, 2. *Alpillina antiqua* FOURY.
1. Subaxial section; sample S 393.
2. Transverse section; sample S 393.

Fig. 3. *Paracoskinolina*? *jourdanensis* FOURY & MOULLADE. Axial section; sample S 398.

Figs. 4, 5. *Orbitolinopsis debelmasi* MOULLADE & THIEULOY.
4. Subaxial section; sample S 393.
5. Transverse section; sample S 393.

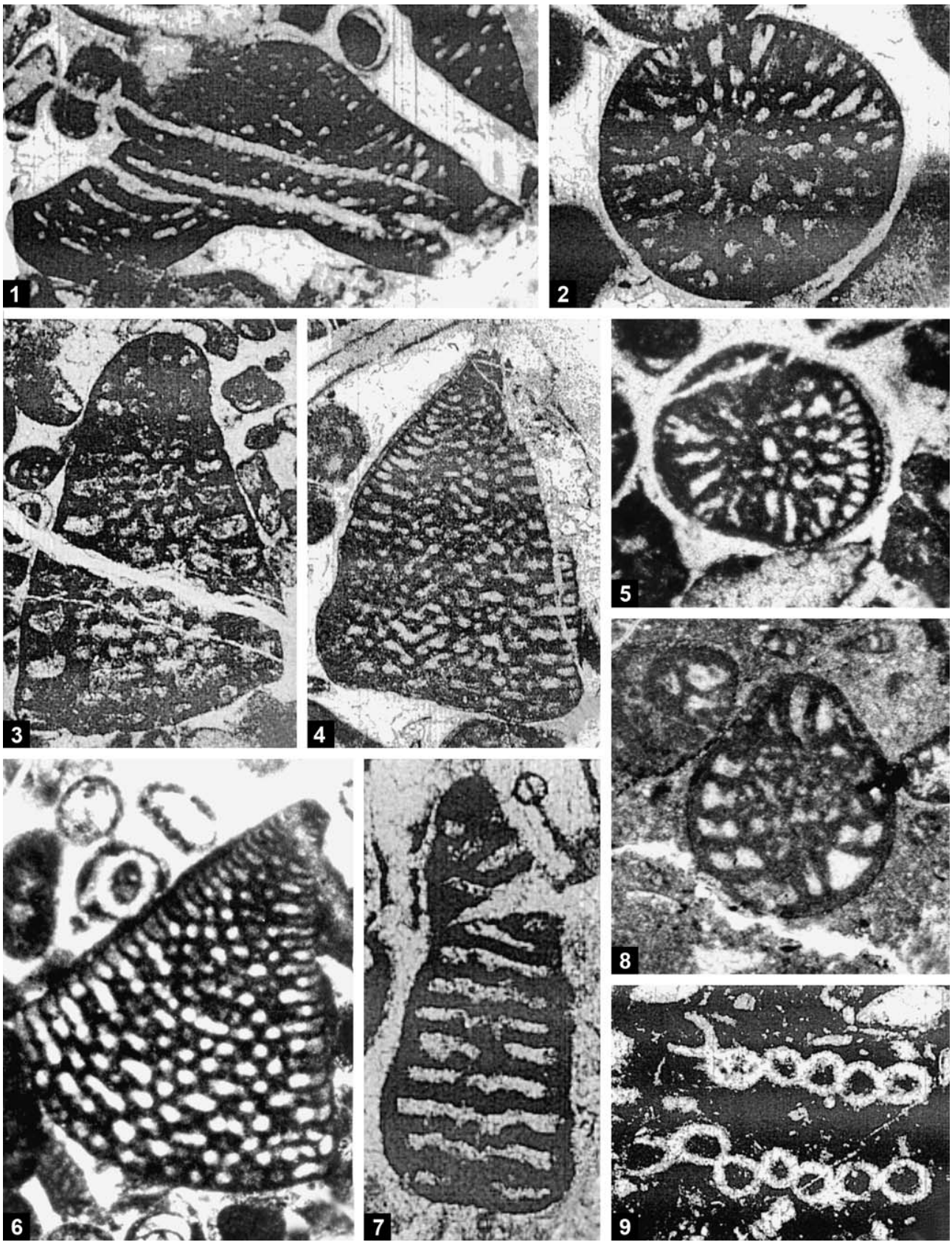
Fig. 6. *Orbitolinid* gen. et sp. indet. Subaxial section; sample S 403.

Fig. 7. *Pseudolituonella gavonensis* FOURY. Subaxial section; sample S 400.

Fig. 8. *Pfenderina globosa* (FOURY). Transverse section; sample S 394.

Fig. 9. *Clypeina estevezii* GRANIER. Sample S 401.

All × 52, except Fig. 7 which is × 60.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