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FORAMINIFERA FROM THE LATE JURASSIC AND EARLY CRETACEOUS CARBONATE PLATFORM FACIES OF THE SOUTHERN PART OF THE CRIMEA MOUNTAINS, SOUTHERN UKRAINE

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Abstract: Upper Jurassic and Lower Cretaceous deposits of the Crimea Peninsula are rich in microfossils frequently used for stratigraphic interpretations. In case of foraminifera, the research has been carried predominantly on assemblages obtained by washing the rock samples. The present paper is based on investigations of thin sections from the more indurated sediments that seldom were objects of study. Its goal was to obtain additional information on age and environment of sediments studied. Over 250 thin sections from 16 surface outcrops yielded abundant foraminifera from which over fourty are described herein. Many foraminiferal species (e.g., *Labirynthina mirabilis*, *Parurgonina caelinensis*, *Neokilianina rahonensis*, *Amijella amiji*, *Anchispirocyclina lusitanica*) are stratigraphically significant and known from the Kimmeridgian–Tithonian of the Mediterranean Tethys. The Early Cretaceous fauna is represented by *Protopeneroplis ultragranulata*, *Everticyclammina kelleri*, *Nautiloculina bronnimanni*, *Monsalevia salevensis*, and *Mayncina bulgarica*. Generally, the investigated fauna is typical for paleoenvironment of the carbonate platform. Older (Kimmeridgian–Tithonian) assemblages represent the inner, and younger (Berriasian) outer parts of the platform. Palaeogeographic distribution of many species described from the studied area indicates their affiliation with cosmopolitan biota known from the north Tethyan shelf. Additionally, few calcareous cysts of Dinoflagellata have been identified and described.

Key words: foraminifers, dinoflagellata, Upper Jurassic, Lower Cretaceous, Crimea.

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INTRODUCTION

The Crimean microfossil stratigraphy of the Upper Jurassic–Lower Cretaceous deposits has been based mainly on foraminifera described by Russian and Ukrainian palaeontologists (*vide* Kuznetsova & Gorbatchik, 1985; Gorbatchik & Kuznetsova, 1994). In majority of cases, microfossils were extracted from soft or moderately compact rocks by washing samples with water. Micropalaeontological studies of thin sections were rare (Voloshina *et al.*, 1965; Gorbatchik & Mohamad, 1997). Indurated rocks, however, supply very important palaeontological information useful in stratigraphical or palaeoenvironmental interpretations (Sliter, 1989, 1999). This encouraged present authors to complete microbiostratigraphy of the Upper Jurassic sediments of the SW segment of the Crimea Mountains based on the data from thin sections (Fig. 1A). The examined samples yielded rich foraminiferal fauna, which can be used for stratigraphical and environmental investigations. Based on microfaunal data, the paper presents the results of new studies from bedded and massive facies of the Upper Jurassic sediments which represent central part of the Crimea Mountains.

GEOLOGICAL SETTING

The Crimea Mountains occupy the southern, maritime part of the Crimea Peninsula and form a narrow belt extending nearly W–E at a distance of more than 150 km (Fig. 1A). The basement of the Upper Jurassic rocks shows a

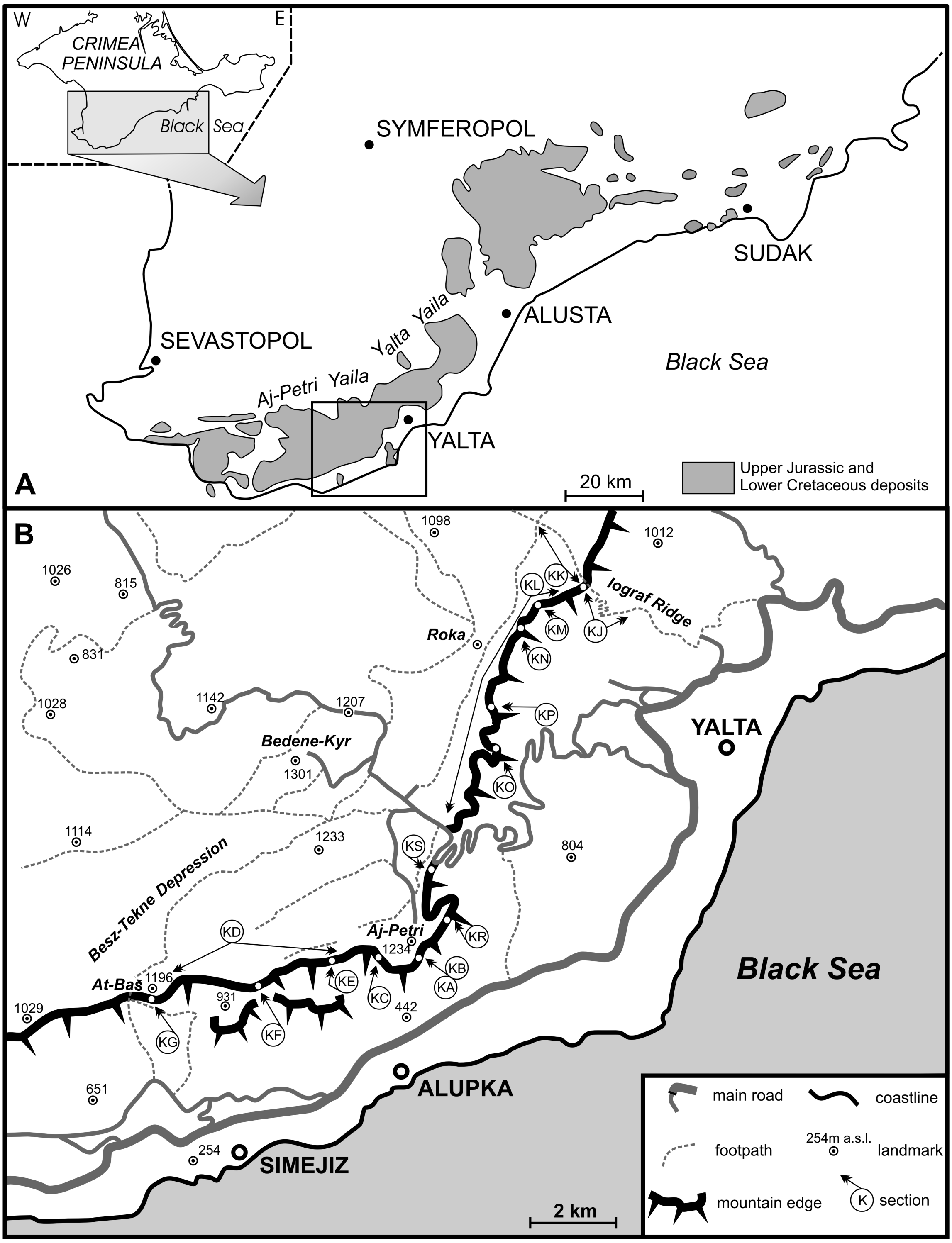

Fig. 1 Location of the study area. **A.** Upper Jurassic–Lower Cretaceous deposits in the Crimea Mountains; after Yudin 2001, simplified. **B.** Location of sections between Iograf Ridge and At-Baś Mountain

complicated structure, including a number of intrusive bodies, thrusts of chaotic complexes, faults and tectonic melanges (Nikishin *et al.* 1998; Yudin, 1999, 2001; Mileev *et al.*, 2006).

The main ridge of the Crimea Mountains includes an allochthonous complex that is composed of thrusts of Upper Jurassic and Lower Cretaceous rocks. This complex unconformably overlies folded flysch strata of the Tauride series (Upper Triassic–Lower Jurassic; Fig. 2). Five main series were distinguished within the Crimea Mountains: Eskiorda, Taurida, Karadag, Sudak, and Yaila (Fig. 2; Mileev *et al.*, 2006; cf. Leshukh *et al.*, 1999).

Rocks building the main part of the Crimea Mountains span a time interval between Callovian and Berriasian (Sudak and Yaila series), although stratigraphic sequence is sometimes disturbed due to complicated tectonic deformations (cf. Mileev & Baraboshkin, 1999), and additionally in certain regions strata of some stages do not occur at all. Deposition in the Crimea Mountains area proceeded in a back-arc basin, which was filled with shallow- to relatively deep-water marine sediments, close to land areas within marginal parts of an epicontinental basin that surrounded the Tethys from the north (Zonnenshain & Le Pichon, 1986; Golonka, 2004).

The Crimea Mountains are subdivided into several smaller massifs (called Yaila), up to 1.500 m a.s.l. Individual massifs, although situated side by side, frequently represent tectonically isolated fragments that are characterized by different morphology, lithology and stratigraphic position of Upper Jurassic and Lower Cretaceous strata. The subject of interest: the Aj-Petri and Yalta Yaila massifs (Fig. 1B), are mainly composed of Tithonian and Berriasian rocks belonging to the Yaila Series (Krajewski & Olszewska, 2006; Mileev *et al.*, 2006).

The gross part of Aj-Petri and Yalta Yailas is mainly composed of thick complexes of bedded limestones, showing variable bed thicknesses: from finely laminated to thick-bedded ones. Thin-bedded marly limestones are ubiquitous. Massive limestones facies of carbonate buildups occur rarely within carbonates of the area. The studies of bedded and massive facies in the western Crimea Mountains indicate that the Aj-Petri and Yalta massifs are mainly built up of limestones representing mostly shallow water facies (peloidal, oncoidal, detrital, coral, stromatoporoid, microbial and marly) as well as sandy limestones and sandstones (e.g., Leshukh *et al.*, 1999; Krajewski & Olszewska, 2006; Mileev *et al.*, 2006)

METHODS

The presented material was collected from massive and bedded limestones and from marly limestones. A few hundred samples were collected, from which thin and polished sections were made. The material was collected from seventeen sections between Iograf Ridge and At-Baś Mountain (Fig. 1B). Over 250 thin sections with microfossils were examined under Nikon Eclipse LV100 Pol microscope. Photos of microfossils were taken with the aid of Nikon photomicrographic attachements Microflex HFX- DX and NIS-Elements Documentation, alternatively.

As a result of complex fault tectonics of this region, the stratigraphic position of the Aj-Petri and Yalta Yailas sediments is uncertain. Since only a few ammonites were found in the Yalta Yaila limestones (Oviechkin, 1956; M. A. Rogov, pers. comm.), this paper deals with data provided by foraminiferal studies. Although stratigraphy based on microfossils is not as precise as the orthostratigraphic scheme based on ammonites, foraminifers are ubiquitous in the studied sediments, unlike ammonites.

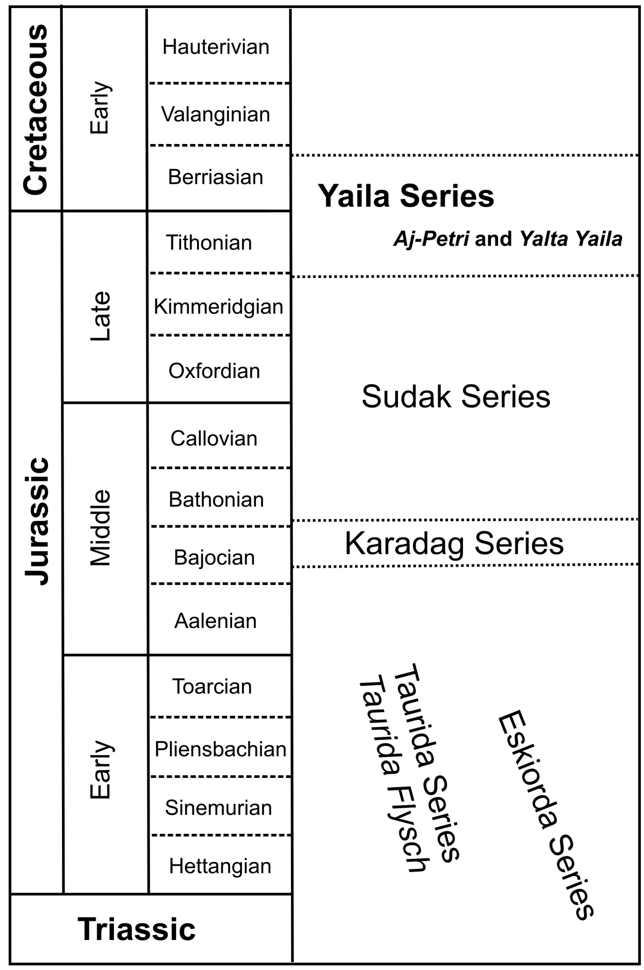

Fig. 2. General stratigraphy of the Crimea Mountains after Mileev *et al.*, 2006; modified

Furthermore, due to complicated tectonics in some areas, the strata are disturbed (Mileev & Baraboskhin, 1999) and it is difficult to estimate thickness of the deposits and their stratigraphy. According to some older papers, the total thickness reaches a few thousand meters, but it is probably a tectonic effect (cf. Leshukh *et al.*, 1999). Therefore, more probable thickness would be estimated from hundreds to one thousand meters for each sedimentary unit. It is difficult to create realistic general lithostratigraphical section for the area.

PALAEONTOLOGICAL CHART

Foraminifera prevail in all microfossil assemblages from the investigated sediments. Benthic forms are the main components. More than fourty benthic species have been identified and described, many for the first time from the region (Figs 4–9). In one sample only, representative of planktic *Globuligerina* was spotted. Kimmeridgian assemblages are more diversified and contain large, imperforate forms with complex interior typical for carbonate platforms (*Pseudocyclammina*, *Everticyclammina*, *Rectocyclammina*,

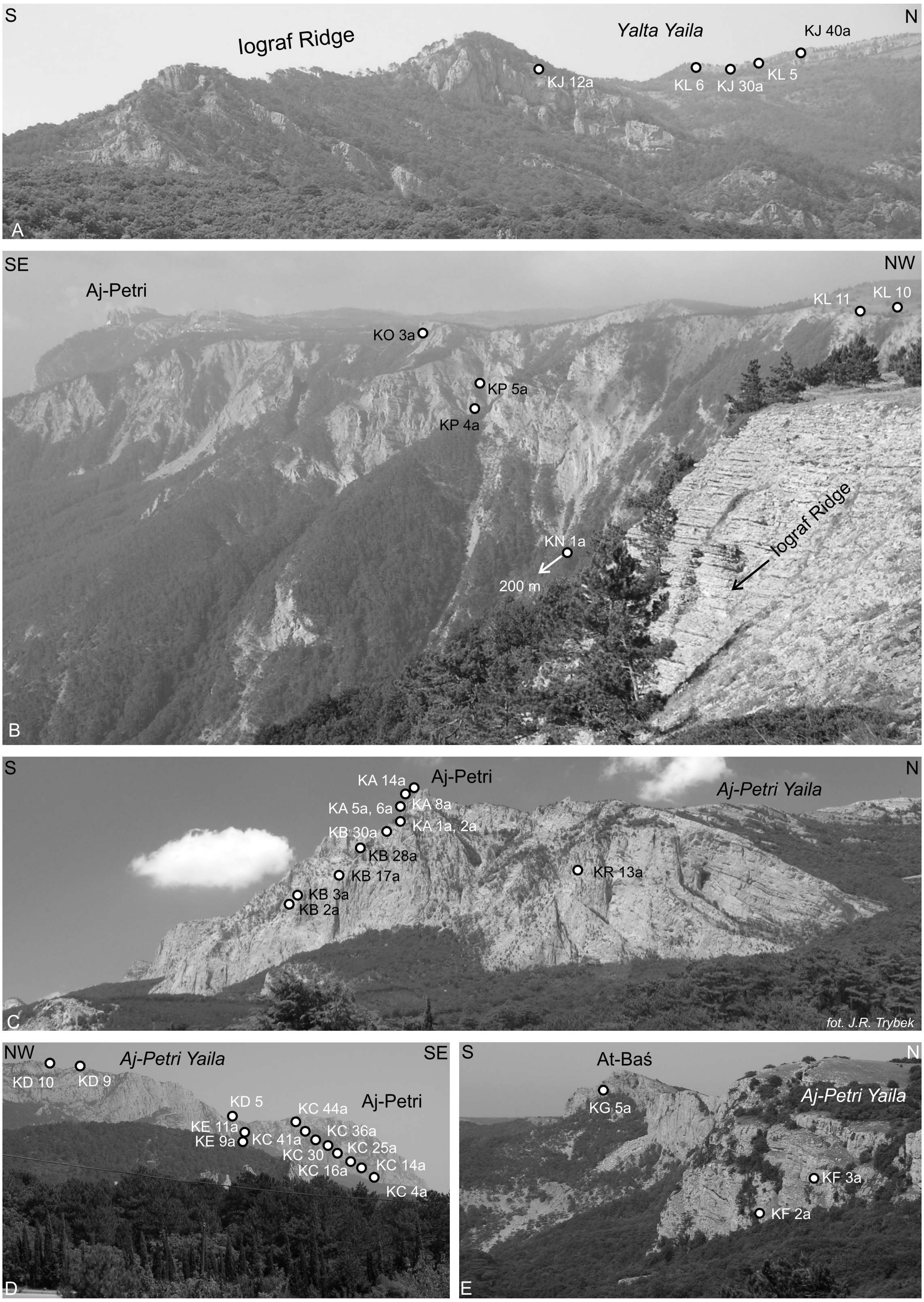

Fig. 3. The southern escarpment of the Yalta and Aj-Petri Yaila with location of the samples presented in Figs 4–9

Amijella, *Labirynthina*). The Tithonian–Berriassian assemblages are rich in small forms, especially miliolids and "trocholinas" associated with carbonate build-ups. In both groups, there are numerous species useful for stratigraphical interpretation of investigated sediments (Fig. 9). Noteworthy is the presence of calcareous cysts of dinoflagellata. Three characteristic species of these groups have been also described.

FORAMINIFERA

Foraminiferal taxonomy follows schemes elaborated by Kaminski (2004) for agglutinated foraminifera as well as Loeblich & Tappan (1988), Neagu (1984, 1994, 1995) and Septfontaine (1988) for calcareous foraminifera.

Class Foraminiferea d'Orbigny, 1926
Order Lituolida Lankester, 1885
Suborder Lituolina Lankester, 1885
Family Lituolidae de Blainville, 1827
Genus *Ammobaculites* Cushman, 1910

Ammobaculites coprolithiformis Schwager, 1867
Fig. 4A

1867. *Haplophragmium coprolithiformis* n.sp.: Schwager, p. 654, pl. 34, fig. 3 (fide Ellis & Messina, 1941-2007).
1970. *Haplophragmium coprolithiforme* Schwager: Winter, p. 8, pl. 1, figs 1-21, text-fig. 6.
1981. *Ammobaculites coprolithiformis* (Schwager): Barnard, Cordey & Shipp, p. 389-391, pl. 1, fig. 9, text-fig 4.

Remarks. Longitudinal section shows a tightly coiled, planispiral early part and a short rectilinear, uncoiled adult part.
Range. Oxfordian–Kimmeridgian.
Occurrence. Section KC.

Genus *Troglotella* Wernli & Fookes, 1992

Troglotella incrustans Wernli & Fookes, 1992
Fig. 4B

1992. *Troglotella incrustans* Wernli & Fookes n. sp.: Wernli & Fookes, p. 97-102, pl. 1 fig.15; pl. 2, figs 1-12.
1996. *Troglotella incrustans* Wernli & Fookes: Bucur, Senowbari-Daryan & Abate, p. 69, pl. 2, fig. 3; pl. 5, figs 6, 9, 10.
1999. *Troglotella incrustans* Wernli & Fookes: Schlagintweit & Ebli, p. 404, pl. 3, fig. 4; pl. 6, figs 7, 9, 10.

Remarks. Longitudinal sections show typical set of slightly inflated chambers of variable shape. The early stage, uniserial, boring, is followed by an adult stage horizontally attached to the substrate.
Range. Kimmeridgian–Berriasian.
Occurrence. Sections:KA, KB, KC, KG, KJ, KK, KR.

Suborder Spiroplectamminina Mikhalevich, 1992
Family Textulariopsidae Loeblich & Tappan, 1982
Genus *Aaptotoichus* Loeblich & Tappan, 1982

Aaptotoichus challengeri Holbourn & Kaminski, 1997
Fig. 4C

1997. *Aaptotoichus challengeri* Holbourn & Kaminski n. sp.: Holbourn & Kaminski, p. 46-47, pl. 16, figs 6-8; pl. 17, figs 1-4.

Remarks. Longitudinal sections show an early, short biserial stage with bulbous chambers and a following uniserial stage with low chambers subdivided by horizontal sutures.
Range. Tithonian–Barremian.
Occurrence. Sections: KE, KL, KO.

Genus *Haghimashella* Neagu & Neagu, 1995

Haghimashella arcuata Haeusler, 1890
Fig. 4 D

1890. *Bigenerina arcuata* n.sp.: Haeusler, p. 73. (fide Ellis & Messina, 1941-2007).
1968. *Bigenerina arcuata* Haeusler: Oesterle, p.742, text-fig. 37-39.
1995. *Haghimashella arcuata* (Haeusler): Neagu & Neagu, p. 216, pl. 2 figs 1-11.

Remarks. Longitudinal sections show the early biserial stage followed by variously inclined adult, uniserial part. Commonly occur isolated biserial parts caused by breaking of fragile specimens.
Range. Middle Oxfordian–Berriasian.
Occurrence. Sections: KB, KC, KJ, KN.

Suborder Verneuilina Mikhalevich & Kaminski, 2004
Family *Verneuilinidae* Cushman, 1911
Genus *Paleogaudryina* Said & Bakarat, 1958

Paleogaudryina magharaensis Said & Bakarat (1958)
Fig. 4E

1958. *Paleogaudryina magharaensis* n.sp.: Said & Bakarat, p. 243, pl.3, fig. 42; pl. 4, figs 33-36.
2005. *Paleogaudryina magharaensis* Said & Bakarat: Olszewska, p. 4, fig. 12.

Remarks. Common species, usually occurs in separate parts of the triserial and biserial stages. Differs from the *Paleogaudryina varsoviensis* (Bielecka & Pożaryski, 1954) in larger triserial stage and flattened chambers of the biseral stage giving almost rectangular outline in the transversal sections. Similar in shape and stratigraphic distribution *Gaudryina bukowiensis* Cushman & Glazewski (1949) from the Nizhniov suite of Ukraine differs in being much larger.
Range. Late Kimmeridgian–Middle Berriasian.
Occurrence. Sections: KA, KB, KF, KG, KK, KL, KN, KR.

Paleogaudryina varsoviensis
(Bielecka & Pożaryski, 1954)
Fig. 4F

1954. *Neobulimina varsoviensis* n.sp.: Bielecka & Pożaryski, p. 65, pl. 10, fig. 50.
1980. *Paleogaudryina varsoviensis* (Bielecka & Pożaryski): Bielecka, In: Malinowska (ed.), p. 303, pl. 82, fig. 10.

Remarks. Mode of occurrence of the species resembles that of *Paleogaudryina magharaensis* Said & Bakarat. It differs in being longer, much slender, having a shorter triserial stage and in more inflated chambers of the biserial part.
Range. Late Oxfordian–Tithonian.
Occurrence. Sections: KA, KC, KD, KE, KG, KL, KO.

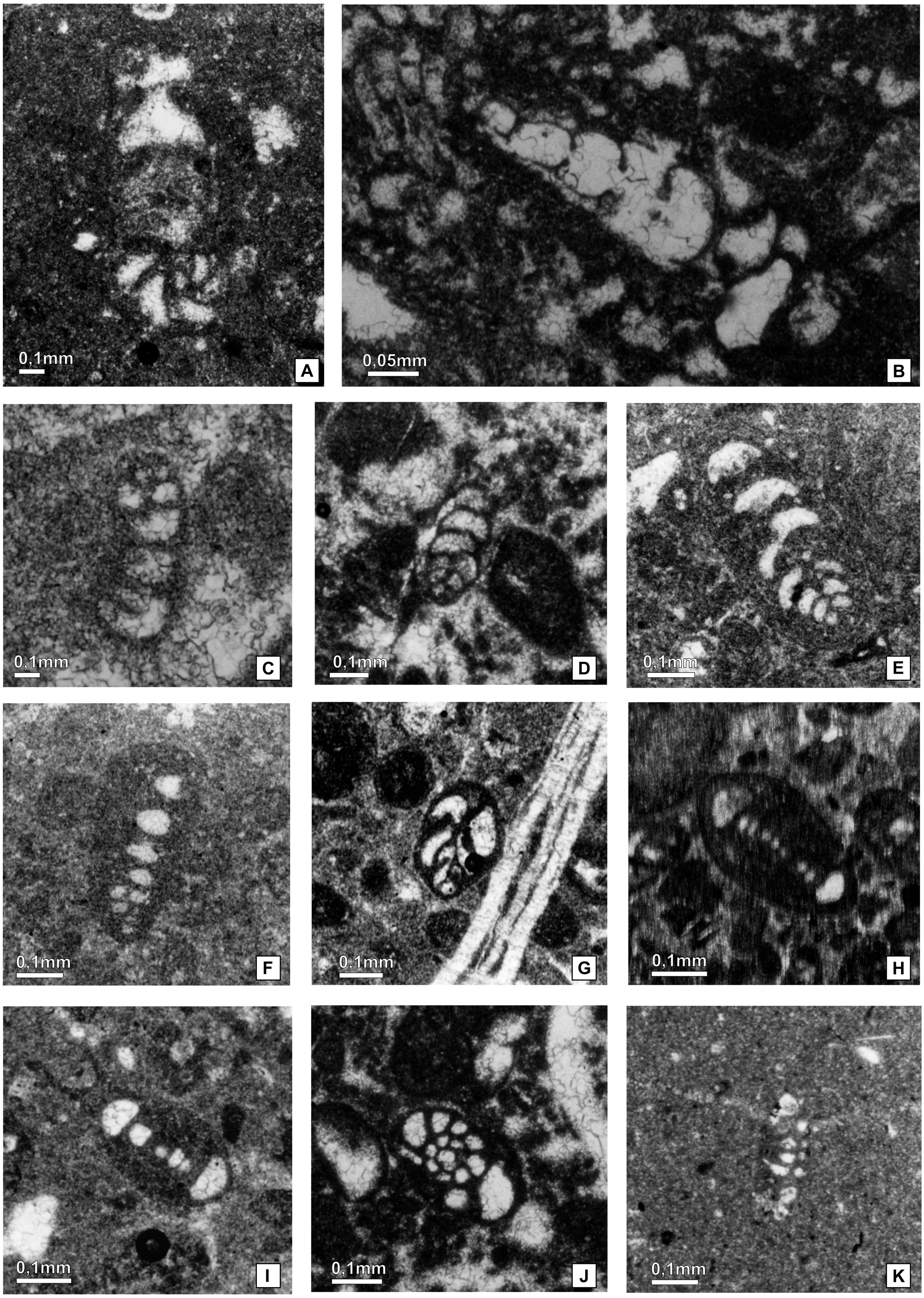

Fig. 4. **A** – *Ammobaculites coprolithiformis* (Schwager), (KC 30a); **B** – *Troglotella incrustans* Wernli & Fookes, (KA-6a); **C** – *Aaptotoichus challengeri* Holbourn & Kaminski, (KE 9a); **D** – *Haghimashella arcuata* (Haeusler), (KC 4a); **E** – *Paleogaudryina magharaensis* Said & Bakarat, (KL 5); **F** – *Paleogaudryina varsoviensis* (Bielecka & Pożaryski), (KA 2a); G – *Uvigerinammina uvigeriniformis* (Seibold & Seibold), (KL 6); **H** – *Nautiloculina bronnimanni* Arnaud-Vanneau & Peybernès, (KJ 40a); **I** – *Nautiloculina oolithica* Mohler, (KF 4a); **J**, **K** – *Mayncina bulgarica* Laugh, Peybernès & Rey, (KJ 12a)

Genus *Verneuilinoides* Loeblich & Tappan, 1949

Verneuilinoides polonicus (Cushman & Glazewski, 1949)
Fig. 8 B

1949. *Verneuilina polonica* n.sp.: Cushman & Glazewski, p. 7, pl. 1, figs 14, 15.
1989. *Verneuilina* cf. *polonica* Cushman & Glazewski: Arnaud-Vanneau & Masse, p. 264-265.
1997. *Verneuilinoides polonicus* (Cushman & Glazewski): Neagu, p. 313, Fig. 4 (13-19); Fig. 5 (39-49).

Remarks. The subaxial sections show distinct triserial arrangement of the slowly enlarging weakly inflated chambers with characteristic thick walls.
Range. Tithonian–Early Valanginian.
Occurrence. Sections: KD, KF.

Family Reophacellidae Mikhalevich & Kaminski, 2004
Genus *Uvigerinammina* Majzon, 1943

Uvigerinammina uvigeriniformis
(Seibold & Seibold, 1960)
Fig. 4G

1960. *Gaudryina uvigeriniformis* n.sp.: Seibold & Seibold, p. 334, 335; text-fig. 8b, pl. 7, fig. 4.
1995. *Uvigerinammina uvigeriniformis* (Seibold & Seibold): Neagu & Neagu, p. 218, pl. l2, figs 28-43; pl. 6, figs 11-14.
2005. *Uvigerinammina uvigeriniformis* Seibold & Seibold): Olszewska, p 34, p. 5, fig. 1.

Remarks. Axial sections show typical for the species sphaerical initial chamber, alternating attachment of chambers and their sack-like shape.
Range. Middle Oxfordian–Early Valanginian.
Occurrence. Sections: KL, KN.

Family Nautiloculinidae Loeblich & Tappan, 1985
Genus *Nautiloculina* Mohler, 1938

Nautiloculina bronnimanni Arnaud Vanneau
& Peybernès, 1978
Fig. 4H

1978. *Nautiloculina bronnimanni* n.sp.: Arnaud Vanneau & B. Peybernès, p. 70, pl.1, figs 6-8; pl. 2, figs 4-11.
1998. *Nautiloculina bronnimanni* Arnaud-Vanneau & Peybernès: Ebli & Schlagintweit, p. 13, pl. 2, figs 5, 6.
2003. *Nautiloculina broennimanni* Arnaud-Vanneau & Peybernès: Dragastan & Richter, p. 93, pl. 1, fig. 2; pl. 9, figs 10, 11, 16 n.
2004. *Nautiloculina bronnimanni* Arnaud-Vanneau & Peybernès: Ivanova & Koleva-Rekalova, p. 220, pl. 1, fig. 5.

Remarks. Axial sections show, typical for the species, slightly acute periphery, 6 whorls of semicircular chambers and characteristic projections (septa) over apertural part of the preceding chamber.
Range. Berriasian–Hauterivian.
Occurrence. Sections: KA, KB, KC,KD, KF, KJ.

Nautiloculina oolithica Mohler, 1938
Fig. 4I

1938. *Nautiloculina oolithica* n.sp.: Mohler, p. 19, pl. 4, figs 1-3 (fide Ellis & Messina 1941-2007).
1967. *Nautiloculina oolithica* Mohler: Brönimann, p. 54-61, p;. 1, figs 1-6; pl. 2, figs 1-9; pl. 3, figs 1-9; text-figs 1-4.
1971. *Nautiloculina oolithica* Mohler: Ramalho, p. 143, pl. 13, figs 12, 13.
1984. *Nautiloculina oolithica* Mohler: Bernier, p. 514, pl. 16, figs 7-9.

Remarks. The species differs from *Nautiloculina bronnimanni* in smaller size, larger number of chambers and in much broader periphery. It has also longer stratigraphical distribution.
Range. Late Oxfordian–Berriasian.
Occurrence. Sections: KA, KC, KD, KF, KG, KK, KO, KR.

Family Mayncinidae Loeblich & Tappan, 1985
Genus *Mayncina* Neumann, 1965

Mayncina bulgarica Laugh, Peybernès & Rey, 1968
Fig. 4 J, K

1968. *Mayncina bulgarica* n.sp.: Laug, Peybernès & Rey, p. 68-76; fig. 3, 1-16.
1986. *Mayncina*? aff. *bulgarica* Laug, Peybernès & Rey: Luperto Sinni & Masse, pl. 7, figs 1-3.
1988. *Mayncina* cf. *bulgarica* Laug, Peybernès & Rey: Bucur, pl. 1, fig. 14.
1991. *Mayncina*? sp.: Altiner, pl. 12, figs 1, 2.
2004. *Mayncina bulgarica* Laug, Peybernès & Rey: Ivanova & Koleva-Rekalova, pl. 3, fig. 10.

Remarks. Subequatorial sections of the macrospheric specimens show two whorls composed of slowly enlarging, rectangular chambers, finely agglutinated walls. Sections of the microspherical specimens show more numerous and narrow chambers and tendency to uncoiling. The subaxial sections show successive openings between chambers and acute periphery.
Range. Tithonian–Barremian.
Occurrence. Sections: KA, KC, KJ, KL, KN, KO, KR.

Order Loftusiida Kaminski & Mikhalevich, 2004
Suborder Loftusiina Kaminski & Mikhalevich, 2004
Family Mesoendothyridae Voloshinova, 1958
Genus *Mesoendothyra* Dain, 1958

Mesoendothyra izjumiana Dain, 1958
Fig. 5A

1958. *Mesoendothyra izjumiana* n.sp.: Dain, In: Bykova *et al.*, p. 20, 21 pl. 4, figs 7-9.
1991. *Mesoendothyra izjumiana* Dain: Altiner, pl. 4, figs 1-3.
2004. *Mesoendothyra izjumiana* Dain: Ivanova & Koleva-Rekalova, p. 219, pl. 1, figs 6-9.
2005. *Mesoendothyra izjumiana* Dain: Olszewska, p. 35, pl. IV, figs 5, 6.

Remarks. Axial and subaxial sections show typical, early streptospiral part followed by planispiral late whorl, small number of chambers and a broad external margins.
Range. Late Oxfordian–Tithonian.
Occurrence. Sections: KB, KD, KG.

Genus *Labirynthina* Weynschenk, 1951

Labirynthina mirabilis Weynschenk, 1951
Fig. 5B

1951. *Labirynthina mirabilis* n.sp.: Weynschenk, p. 793.
1984. *Labirynthina mirabilis* Weynschenk: Bernier, p. 515-517,

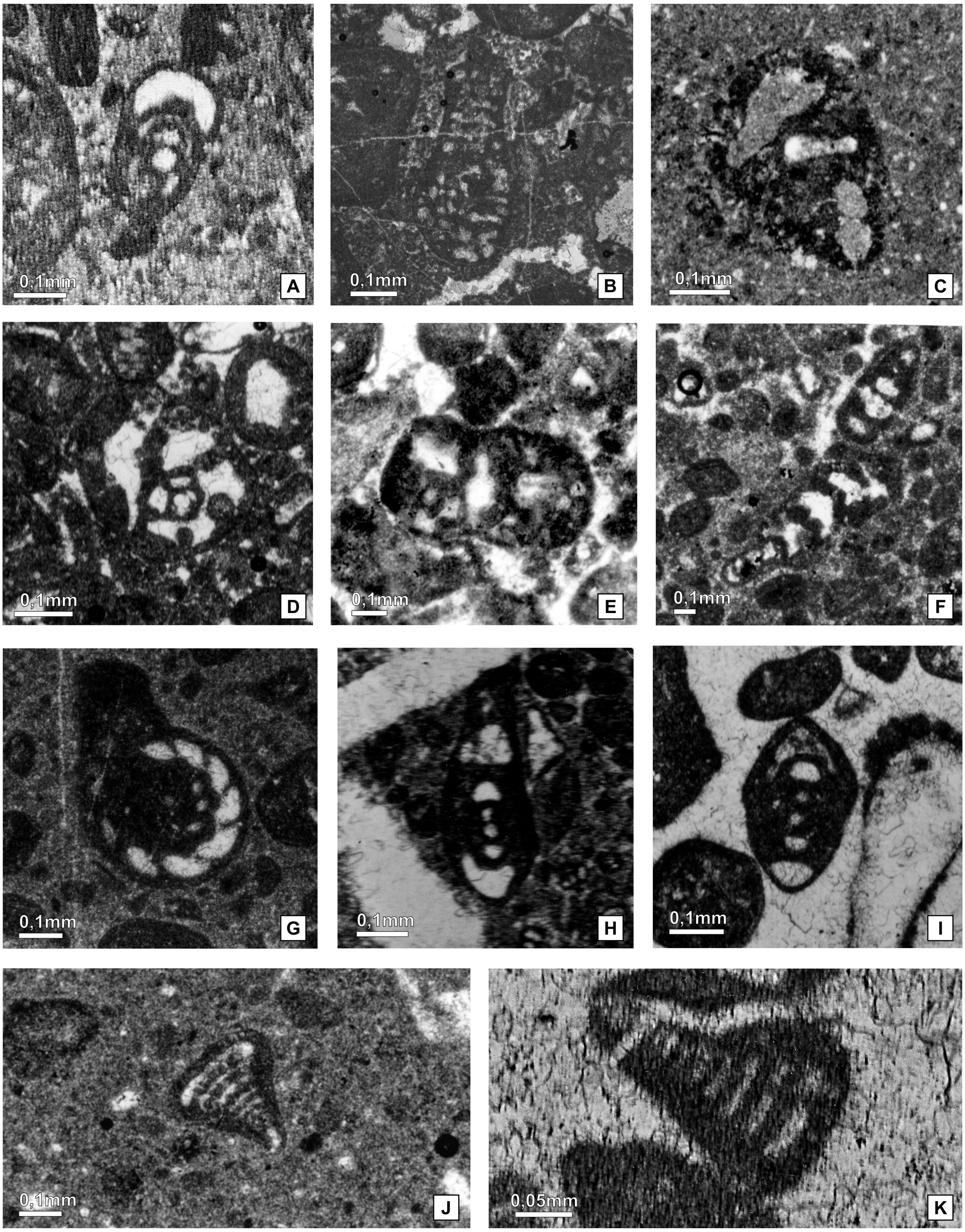

Fig. 5. **A** – *Mesoendothyra izjumiana* Dain, (KD 5); **B** – *Labirynthina mirabilis* Weynschenk, (KA 8a); **C**, **D** – *Everticyclammina praekelleri* Redmond (KP 4a); **E** – *Everticyclammina kelleri* Henson (KL 10); **F** – *Rectocyclammina chouberti* Hottinger (KN 1a); **G**, **H** – *Charentia evoluta* Gorbatchik, (KA 1a); **I** – *Melathrokerion spirialis* Gorbatchik (KC 16a); **J** – *Scythiolina camposaurii* (Sartoni & Crescenti) (KF 3a); **K** – *Montsalevia salevensis* (Charollais, Brönnimann & Zaninetti) (KC 36a)

pl. 19, fig. 3.
1991. *Labirynthina mirabilis* Weynschenk: Altiner, pl. 3, figs 17, 18, 20-22, 24, 19, 23.
1997. *Labirynthina mirabilis* Weynschenk: Bassoulet, p. 301-302.
2004. *Labirynthina mirabilis* Weynschenk: Ivanova & Koleva-Rekalova, p. 218, pl. 2-4.
2006. *Labirynthina mirabilis* Weynschenk: Krajewski & Olszewska, pl.1, fig. 5b.

Remarks. Longitudinal sections show an early involute stage (with characteristic large initial chamber) followed by an evolute, rectilinear late stage. Internal pillars within chambers and their microgranular walls are also visible.
Range. Latest Oxfordian–Early Tithonian.
Occurrence. Sections: KA, KB, KC, KG.

Family Everticyclamminidae Septfontaine, 1988
Genus *Everticyclammina* Redmond, 1964

Everticyclammina kelleri (Henson, 1948).
Fig. 5E

1948. *Pseudocyclammina kelleri* n.sp. Henson, p. 16, 17; pl. 9, figs 4, 5, 7 (fide Ellis & Messina, 1941-2007).
1964. *Everitcyclammina eccentrica* n.sp.: Redmond, p. 408, pl. 1, figs 16-18; pl. 2, figs 12, 13.
1964. *Everticyclammina elegans* n.sp.: Redmond, p. 408-409, pl. 1, figs 19-21; pl. 2, figs 14-16.
1990. *Everticyclammina kelleri* (Henson): Banner & Highton, p. 6, pl. 1, figs 2-6; pl. 2, figs 1-4; pl. 3, figs 1, 2.

Remarks. In the material studied usually occur, planispirally coiled, early stages of the species followed by one chamber of the uncoiled part. To characteristic features belong two whorls and the non alveolar walls of chambers in the coiled stage.
Range. Berriasian–Valanginian.
Occurrence. Sections: KD, KE, KK.

Everticyclammina praekelleri Banner & Highton, 1990
Fig. 5C, D

1990. *Everticyclammina praekelleri* n.sp.: Banner & Highton, p. 8-10, pl. 1, fig. 1; pl. 3, fig. 5; pl. 4, figs 1-11.

Remarks. The species is characterized by thick chamber walls of irregular thickness, irregular shape of chambers and distinct alveoles even in the early part. It differs from *Evericyclammina virguliana* (Koechlin) in having thicker walls, irregular shape of chambers and a smaller number of chambers per whorl.
Range. Kimmeridgian–Tithonian.
Occurrence. Sections: KA, KB, KC, KD, KE, KF, KG, KJ, KL, KN, KO, KP, KR.

Genus *Rectocyclammina*, Hottinger, 1967

Rectocyclammina chouberti Hottinger, 1967
Fig. 5F

1967. *Rectocyclammina chouberti* n.sp.: Hottinger, p. 55, 56, pl. 9, figs 19-21; text-figs 26, 27.
1971. *Rectocyclammina chouberti* Hottinger: Ramalho, p. 144, 145, pl. 14, figs 1-4.
1984. *Rectocyclammina chouberti* Hottinger: Bernier, p. 513-514, pl. 20, fig. 3.
1997. *Rectocyclammina chouberti* Hottinger: Bassoulet, p. 303.
2004. *Rectocyclammina chouberti* Hottinger: Ivanova & Koleva-Rekalova, pl. 1, fig. 1.

Remarks. Axial sections show the early short planispiral whorl followed by uniserial, rectilinear later part composed of the slowly increasing, overlapping chambers with thick septa. In some sections, characteristic alveoles in chamber walls may be observed.
Range. Late Kimmeridgian–Tithonian (?Valanginian).
Occurrence. Sections: KB, KE, KF, KL, KN.

Suborder Biokovinina Kaminski, 2004
Family Charentiidae Loeblich & Tappan, 1985
Genus *Charentia* Neumann, 1965

Charentia evoluta (Gorbatchik, 1968)
Fig. 5G, H

1968. *Tonasia evoluta* n.sp.: Gorbatchik, p. 8, 9; pl. 2, figs 1-5.
1975. *Charentia evoluta* (Gorbatchik): Kuznetsova & Gorbatchik, p. 82, 83; pl. 3, figs 5, 6.
1999. *Charentia evoluta* (Gorbatchik): Neagu, p. 292, pl. 3, figs 24-29; pl. 9, figs 25, 26.
2005. *Charentia evoluta* (Gorbatchik): Olszewska, p. 35, pl. IV, figs 7, 8.

Remarks. Horizontal sections of the early, planispiral part show rectangular chambers subdivided by thin septa. In axial sections (unlike in the genus *Nautiloculina*) the base of chambers lack internal projections. Sections of specimens with uncoiled late part occur rarely.
Range. Late Kimmeridgian–Valanginian.
Occurrence. Sections: KA, KC, KD, KF, KJ, KK, KN, KR.

Genus *Melathrokerion* Brönnimann & Conrad, 1967

Melathrokerion spirialis (Gorbatchik, 1968)
Fig. 5I

1968. *Melathrokerion spirialis* n.sp.: Gorbatchik, p. 6, 7; pl. 1 figs 1-6.
1985. *Melathrokerion spirialis* Gorbatchik: Kuznetsova & Gorbatchik, p. 81, pl. 3, fig. 4.

Remarks. Axial sections show typical subacute periphery, streptospiral early whorl, thick septa between chambers (unlike in the genus *Charentia*) and coarse alveolar canaliculi.
Range. Tithonian–Valanginian (predominantly on the Carpathian-Crimea area).
Occurrence. Sections: KB, KC, KE, KF, KL, KR.

Family Montsaleviidae Zaninetti, Salvini-Bonnard, Charollais & Decrouez, 1987
Genus *Montsalevia* Zaninetti, Salvini Bonnard, Charollais & Decrouez, 1987

Montsalevia salevensis (Charollais, Brönnimann & Zaninetti, 1966)
Fig. 5K

1966. *Pseudotextulariella salevensis* n.sp.: Charollais, Brönnimann & Zaninetti, p. 28-34, pl. 1, figs 1-5; pl. 2, figs 2, 6; text-fig. 1.
1987. "*Montsalevia*" *salevensis* (Charollais, Brönnimann & Zaninetti): Zaninetti, Charollais & Decrouez, p. 168.

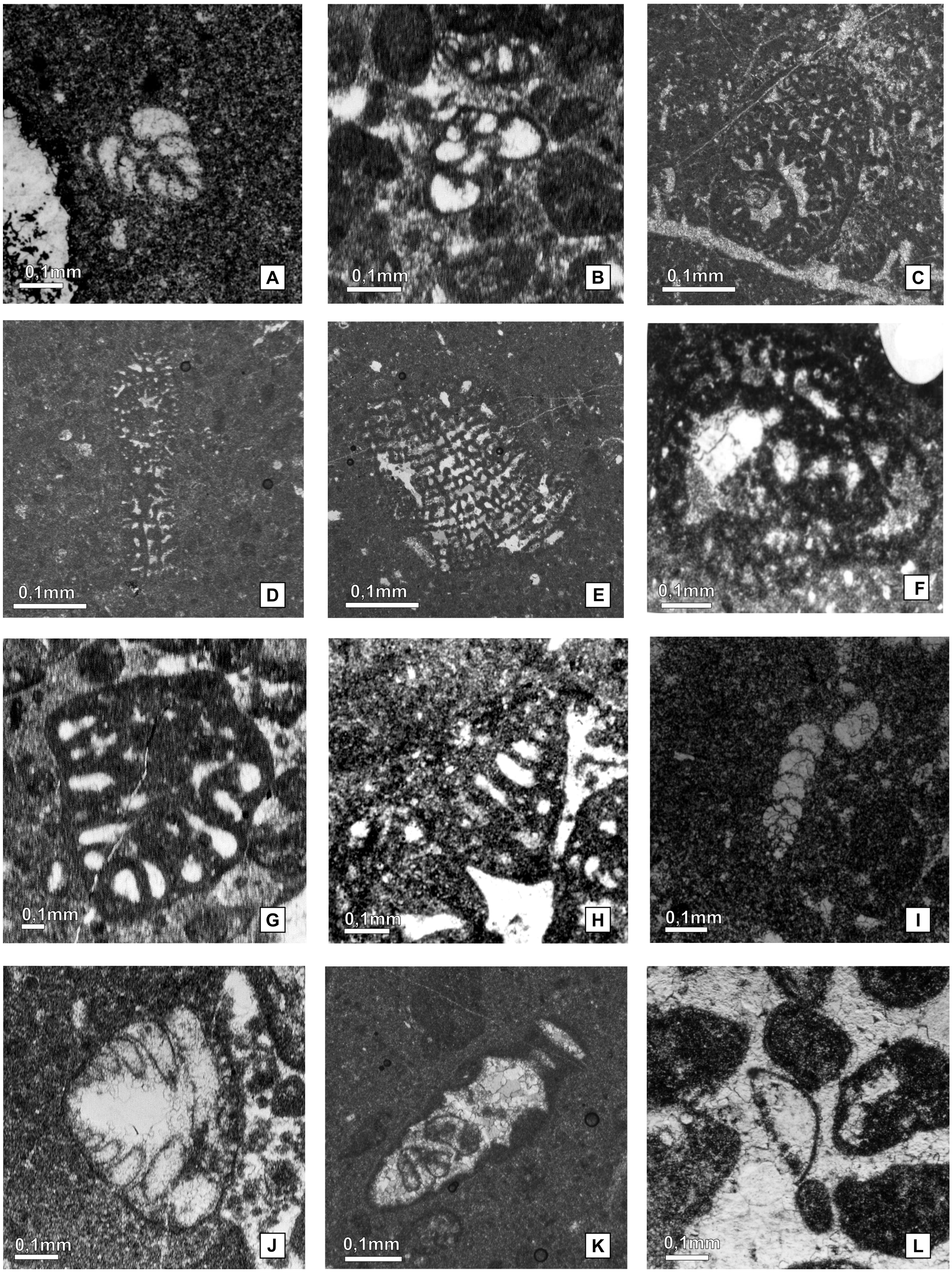

Fig. 6. **A** – *Siphovalvulina variabilis* Septfontaine (KE 11a); **B** – *Dobrogelina ovidi* Neagu (KC 44a); **C** – *Amijella amiji* (Henson) (KG 5a); **D**, **E** – *Anchispirocyclina lusitanica* (Egger) (KL 11); **F** – *Pseudocyclammina lituus* (Yokoyama) (KJ 30a); **G** – *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano (KD 9); **H** – *Neokilianina rahonensis* (Foury & Vincent) (KD 10); **I** – *Bigenerina erecta* Dain (KA 14a); **J** – *Andersenolina alpina* (Leupold) (KA 1a); **K** – *Andersenolina elongata* (Leupold) (KF 2a); **L** – *Ichnusella burlini* (Gorbatchik) (KB 3a)

1988. *Pseudotextulariella salevensis* Charollais, Brönnimann & Zaninetti: Bucur, pl. 2, figs 11, 12.
2004. *Montsalevia salevensis* (Charollais, Brönnimann & Zaninetti): Ivanova & Koleva-rekalova: p. 220, pl. 2, figs 4-6.
2004. *Montsalevia salevensis* (Charollais, Brönnimann & Zaninetti): Ivanova & Kołodziej, pl. 1, fig. K.

Remarks. Oblique section shows succession of low chambers and traces of vertical partitions in the biserial part.
Range. Late Berriasian–Hauterivian.
Occurrence. Section KC.

Family Cuneolinidae Saidova, 1981
Genus *Scythiolina* Neagu, 2000

Scythiolina camposaurii (Sartoni & Crescenti, 1964)
Fig. 5J

1964. *Cuneolina camposaurii* n.sp.: Sartoni & Crescenti, p. 275-277, pl. 24, fig. 1; pl. 48, figs 1-6.
1984. *Cuneolina camposaurii* Sartoni & Crescenti: Luperto Sinni & Masse, pl. 41, figs 4, 5.
1988. *Cuneolina camposaurii* Sartoni & Crescenti: Bucur, pl.1, figs 13, 14.
2000. *Scythiolina camposauri* (Sartoni & Crescenti): Neagu, p. 369, pl.1, figs 41-44; pl. 2, figs 18-29, pl. 4, figs 50, 54; pl. 7, figs 7-10.

Remarks. Sections paralell with the plane of biseriality show typical for the species flabelliform shape of the test, short early planispiral stage and vertical radial partitions within late chambers.
Range. Latest Berriasian–Barremian.
Occurrence. Section KF.

Suborder Orbitolinina Kaminski 2004
Family Pfenderinidae Smout & Sugden, 1962
Genus *Siphovalvulina* Septfontaine, 1988

Siphovalvulina variabilis Septfontaine, 1988
Fig. 6A

1988. *Siphovalvulina variabilis* n.sp.: Septfontaine, p. 245.
1991. *Siphovalvulina variabilis* Septfontaine: Darga & Schlaginweit, p. 214, pl. 4, fig. 14.
2004. *Siphovalvulina variabilis* Septfontaine: Ivanova & Koleva-Rekalova, pl. 3, fig. 8.

Remarks. Longitudinal sections show internal canal parallel to the axis of coiling and the sack-like shape of chambers.
Range. Middle Jurassic–Tithonian
Occurrence. Sections: KA, KE, KL, KR.

Genus *Dobrogelina* Neagu, 1979

Dobrogelina ovidi Neagu, 1979
Fig. 6B

1979. *Dobrogelina ovidi* n. sp.: Neagu, p. 494, pl. 1, figs 1-7; pl. 4, figs 17, 18.
2004. *Dobrogelina ovidi* Neagu: Ivanova & Koleva-Rekalova, pl. 3, figs 9, 11.

Remarks. Axial and oblique sections show convex spiral side, inflated chambers and characteristic deep umbilicus.
Range. Berriasian–Valanginian.
Occurrence. Sections: KC, KJ, KL, KN, KR.

Genus *Amijella* Loeblich & Tappan, 1985

Amijella amiji (Henson, 1948)
Fig. 6C

1948. *Haurania amiji* n. sp.: Henson, p. 12; pl. 15, figs 5-10.
1967. *Haurania amiji* Henson: Hottinger, p. 52, pl. 8, figs 1-6, 20-21, text-fig. 2.
1991. *Amijella amiji* (Henson): Schlaginweit, p. 248-250, pl. I, figs 1-10.
1991. *Amijella amiji* (Henson): Darga & Schlaginweit, p. 212, pl. 4, figs 9, 10, 12.
1997. *Bramkampella arabica* Redmond: Gorbatchik & Mohamad, pl. 1, figs 8, 9, 11.

Remarks. The subaxial section of typical club-like specimen show a globular initial chamber and slowly enlarging successive chambers with intense subepidermal network of beams and horizontal rafters. Schlaginweit (1991) after the thorough investigation of genera *Amijella* Loeblich & Tappan (1985) and *Bramkampella* Redmond (1964) came to conclusion that they have identical structure thus are synonimous.
Range. Tithonian–Berriasian.
Occurrence. Sections: KB, KC, KD, KF, KG, KJ, KK, KL, KN, KP, KR.

Genus *Anchispirocyclina* Jordan & Applin, 1952

Anchispirocyclina lusitanica (Egger, 1902)
Fig. 6D, E

1902. *Dicyclina lusitanica* n.sp.: Egger, p. 585-586, pl. 6, fig. 3-5 (*vide* Ellis & Messina 1941-2007).
1971. *Anchispirocyclina lusitanica* (Egger): Ramalho, p. 148-149, pl. 8, fig. 2; pl. 10, fig. 1; pl. 15, figs 4-9; pl. 16, figs 1, 2.
1991. *Anchispirocyclina lusitanica* (Egger); Darga & Schlaginweit, p. 213, pl. 2, fig. 2; pl. 4, figs 2, 3.
1997. *Anchispirocyclina lusitanica* (Egger): Bassoulet, p. 303.
1998. *Anchispirocyclina lusitanica* (Egger): Ebli & Schlagintweit, p. 12, pl. 1, fig. 6.
1999. *Anchispirocyclina lusitanica* (Egger): Schlagintweit & Ebli: p. 398, pl. 5, fig. 9.

Remarks. The axial section (D) shows a slightly asymetrically coiled early part followed by planispiral later part with many chambers (E) irregularly subdivided by beams and rafters.
Range. Tithonian–earliest Berriasian.
Occurrence. Sections: KB, KJ, KK, KL, KN, KO.

Genus *Pseudocyclammina* Yabe & Hanzawa, 1926

Pseudocyclammina lituus (Yokoyama, 1890)
Fig. 6F

1890. *Cyclammina lituus* n.sp.: Yokoyama, p. 26, pl. 5, fig. 7.
1984. *Pseudocyclammina lituus* (Yokoyama): Bernier, p. 513, pl. 19, figs 5, 6.
1991. *Pseudocyclammina lituus* (Yokoyama): Altiner, pl. 7, fig. 9.
1997. *Pseudocyclammina littus* (Yokoyama): Bassoulet, p. 303.
2004. *Pseudocyclammina lituus* (Yokoyama): Ivanova & Koleva-Rekalova, p. 219, pl. 1, fig. 10.
2005. *Pseudocyclammina lituus* (Yokoyama): Olszewska, p. 35, p. IV, fig. 10.
2006. *Pseudocyclammina lituus* (Yokoyama): Kobayashi & Vuks, fig. 5 (7-14).

Remarks. Axial sections show a planispiral early stage, coarsely

agglutinated walls and typical coarse subepidermal network. Uncoiled specimens rarely occur.
Range. Oxfordian–Berriasian.
Occurrence. Sections: KA, KC, KF, KJ, KK, KL, KR.

Family Parurgoninidae Septfontaine, 1988
Genus *Parurgonina* Cuvillier, Foury & Pignatti Morano, 1968
Fig. 6G

1968. *Urgonina* (*Parurgonina*) *caelinensis* n.sp.: Cuvillier, Foury & Pignatti Morano, p. 150-154, pl. II, figs 1-12; pl. III, figs 1-9.
1975. *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano: Schroeder, Guellal & Villa, p. 319-326, pl. 1, figs 1-4; p. 2, figs 3-5.
1984. *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano: Bernier, p. 522-523, pl. 20, figs 4, 5, 7, 8.
1988. *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano: Septfontaine, p. 248-249.
1993. *Paururgonina caelinensis* Cuvillier, Foury & Vicent: Bucur, pl. 4, figs 1-8.
1997. *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano: Bassoulet, p. 302.

Remarks. Subaxial section shows a large globular initial chamber with successive chambers added in trochospiral coil what results in a cone-like shape of the test. In transversal section vertical pillars in the central part of the test are also visible.
Range. Latest Oxfordian–Early Tithonian, mostly Kimmeridgian.
Occurrence. Sections: KA, KC, KR.

Order Textulariidae Delage & Herouard, 1896
Suborder Textulariina Delage & Herouard, 1896
Family Textulariidae Ehrenberg, 1838
Genus *Bigenerina* d'Orbigny, 1826

Bigenerina erecta Dain, 1976
Fig. 6I

1976. *Bigenerina erecta* n.sp.: Dain in Dain & Kuznetsova, p. 54-55, pl. 7, fig. 4.

Remarks. Longitudinal sections show the early, wedge-shaped biserial part and the directly adjacent uniserial, rectilineal late stage.
Range. Tithonian.
Occurrence. Section KA.

Family Paravalvulinidae Banner, Simmons & Whittaker, 1991
Genus *Neokilianina* Septfontaine, 1988

Neokilianina rahonensis (Foury & Vincent, 1967)
Fig. 6H

1967. *Kilianina rahonensis* n. sp.: Foury & Vincent, p. 39-44, pl. 2, figs 1-14.
1984. *Kilianina rahonensis* Foury & Vincent: Bernier, p. 520, pl. 20, fig. 6.
1988. *Neokilianina rahonensis* (Foury & Vincent); Septfontaine, p. 249.
1993. *Kilianina rahonensis* Foury & Vincent: Bucur, pl. 3, figs 4, 5, 8, 9.
1997. *Neokilianina rahonensis* (Foury & Vincent), J.-P. Bassoulet, p. 303.

Remarks. According to Septfontaine (1988), genera *Neokilianina* and *Parurgonina* are morphologically related, the former being an older homeomorph. Longitudinal-oblique section of the poorly preserved specimens shows conical shape of the test with visible chambers of the rectilinear part alternating in position and subdivided into chamberlets.
Range. Kimmeridgian–earliest Tithonian.
Occurrence. Sections: KA, KD.

Suborder Involutinina Hohenegger & Piller, 1977
Family Involutinidae Bütschli, 1880
Genus *Andersenolina* Neagu, 1994

Andersenolina alpina (Leupold, 1936)
Fig. 6J

1936. *Coscinodiscus alpinus* n.sp.: Leupold, p. 610, pl. 18, figs 1-8 (fide Ellis & Messina, 1941-2007).
1991. *Trocholina alpina* (Leupold): Darga & Schlagintweit: p. 214, pl. 4, fig. 1.
1994. *Andersenolina alpina* (Leupold): Neagu, p. 133, text-fig. 4, figs 3, 4; pl. 7, figs. 8, 9; pl. 8, figs 1-10; pl. 12, figs 1-5.
2003. *Andersenolina alpina* (Leupold): Dragastan & Richter, p. 89; pl. 10, figs 1-4.

Remarks. Longitudinal sections show a small cone with the apical angle of 80–95° and 4 to 5 whorls of low, crescentic chambers typical for the species.
Range. Tithonian–Early Valanginian.
Occurrence. Sections: KA, KB, KC, KD, KE, KF, KJ, KK, KL, KN, KR.

Andersenolina elongata (Leupold, 1936)
Fig. 6K

1936. *Coscinodiscus elongatus* n.sp.: Leupold, p. 617, pl. 8, figs 12-14 (fide Ellis & Messina 1941-2007).
1988. *Trocholina elongata* (Leupold): Arnaud-Vanneau, Boisseau & Darsac, p. 356-357, pl. 1, fig. 4; pl. 2, figs 1-8.
1991. *Trocholina elongata* (Leupold): Darge & Schlagintweit: p. 214, pl. 4, fig. 4.
1994. *Andersenolina elongata* (Leupold): Neagu, p. 130, text-fig. 3, fig. 7; pl. 4, figs 1-22; pl. 6, figs 12-14; pl. 12, figs 13-17.
2003. *Andersenolina elongata* (Leupold): Dragastan & Richer, p. 89, 90; pl.10, fig. 7.

Remarks. Longitudinal sections show a long, slender shape of the species composed of over 7 whorls of low chambers and a sharp apical cone of 22°–30°.
Range. Tithonian–Early Valanginan.
Occurrence. Sections: KB, KF, KK, KN.

Genus *Ichnusella* Dieni & Massari, 1966

Ichnusella burlini (Gorbatchik, 1959)
Fig. 6L

1959. *Trocholina burlini* n.sp.: Gorbatchik, p. 81, pl. 4, figs 3-5.
1995. *Ichnusella burlini* (Gorbatchik): Neagu, p. 271, 272; pl. 2, figs 45-48; pl. 3, figs 13-36, 45-48; pl. 13, fig. 10.

Remarks. Characteristic for the species is a low cone of 100–115° and 4–5 whorls of the low chambers. In the longitudinal or transverse sections of the well preserved specimens close to the umbilical side the calcite crystals are visible.

Range. Tithonian–Valanginian.
Occurrence. Sections: KB, KF, KK, KO, KR.

Genus *Neotrocholina* Reichel, 1956 emended Neagu, 1995

Neotrocholina molesta (Gorbatchik, 1959)
Fig. 7A

1959. *Trocholina molesta* n.sp.: Gorbatchik, pl 4 figs 1, 2.
1988. *Trocholina molesta* Gorbatchik: Arnaud-Vanneau, Boisseau & Darsac, p. 359, pl. 6, figs 11-21.
1995. *Neotrocholina burgeri molesta* (Grobatchik): Neagu, p.16-19; pl. 1, figs 13-16, 21, 22, 25, 26; pl. 7, fig. 62-67, 70, 71; pl. 9, figs 1-9; pl. 13, fig. 13, 25, 26.
1998. *Trocholina molesta* (Gorbatchik): Ebli & Schlagintweit, p. 15, pl. 2, fig. 3.
2005. *Neotrocholina molesta* (Gorbatchik): Olszewska, p. 36, 37; pl. V, fig. 12.

Remarks. Test moderately conical with an apical angle of 90–120° and 4 to 6 whorls of the low, crescentic chambers.
Range. Tithonian–Barremian.
Occurrence. Sections: KC, KE, KN, KO.

Family Ventrolaminidae Weynschenk, 1950
Genus *Protopeneroplis* Weynschenk, 1950

Protopeneroplis striata Weynschenk, 1950
Fig. 8D, E

1950. *Protopeneroplis striata* n.sp.: Weynschenk, p. 13, pl.2, figs 12-14.
1991. *Protopeneroplis striata* Weynschenk: Altiner, pl. 3, figs 1-7.
1999. *Protopeneroplis striata* Weynschenk: Schlagintweit & Ebli, p. 402, pl. 6, figs 3, 4.
2005. *Protopeneroplis striata* Weynschenk: Olszewska, p. 37, pl. V, fig. 13.

Remarks. The axial sections show fully planispiral mode of coiling of he species. Axial, subaxial or transversal sections show characteristic two layered chamber walls (“striae”). The internal layer is built of calcite cristals (light in transmitted light) while the external layer is built of microgranular calcite (dark in transmitted light).
Range. Middle-Late Jurassic (up to Tithonian).
Occurrence. Sections. KA, KB, KC, KF.

Protopeneroplis ultragranulata (Gorbatchik, 1971)
Fig. 7C

1971. *Hoeglundina* (?) *ultragranulata* n.sp.: Gorbatchik, p. 135, pl. 26, fig. 2.
1991. *Protopeneroplis trochangulata* Septfontaine: Altiner, pl. 7, figs 1-5.
1996. *Protopeneroplis ultragranulata* (Gorbatchik): Bucur, Senowbari-Daryan & Abate, p. 69-70, pl. 3, figs 14-17.
1999. *Protopeneroplis ultragranulata* (Gorbatchik): Schlagintweit & Ebli, p. 420-423, pl., 6, figs 5, 6, 9.
2004. *Protopeneroplis ultragranulata* (Gorbatchik): Ivanova & Kołodziej, pl. 1, fig. C.
2005. *Protopeneroplis ultragranulata* (Gorbatchik): Olszewska, p. 37, pl. V, figs 15, 16.

Remarks. Characteristic for the species is trochospiral mode of coiling, lack of the microgranular “striae” and the thickened (often recrystallised) hyaline walls of the test.
Range. Middle Late Tithonian–Valanginian.
Occurrence. Sections: KB, KC, KD, KE, KJ, KK, KL, KN, KR.

Suborder Miliolina Delage & Herouard, 1875
Family Cornuspiridae Schulze, 1854
Genus *Meandrospira* Loeblich & Tappan, 1946

Meandrospira favrei Charollais, Brönnimann & Zaninetti, 1966
Fig. 7B

1966. *Citaella*? *favrei* n.sp.: Charollais, Brönnimann & Zaninetti, p. 37-47, pl. 2, figs 3, 4; pl. 3, figs 1-5; pl. 5, figs 1, 2; text-figs 4-6.
1988. *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti): Bucur, pl. 2, figs 1-3.
1991. *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti): Altiner, pl.13, figs 1-5.
1999. *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti): Schlagintweit & Ebli, p. 399-400, pl. 4, figs 8,11.
2004. *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti): Ivanova & Kołodziej, pl.1, figs L, M.

Remarks. Loeblich & Tappan (1988) included genus *Citaella* into the genus *Meandrospira*. Examined specimens in various sections reveal subsphaerical small initial chamber and typically streptospiral undivided tubular, microgranular, second chamber.
Range. Latest Berriasian–Hauterivian.
Occurrence. Sections: KD, KE, KF, KG, KO.

Family Hauerinidae Schwager, 1876
Genus *Decussoloculina* Neagu, 1984

Decussoloculina barbui Neagu, 1984
Fig. 7D

1984. *Decussoloculina barbui* n.sp.: Neagu, p. 81, 82; pl. 2, figs 8-12.
2003. *Decussoloculina barbui* Neagu: Dragastan & Richter, p. 93, pl. 9, fig. 15.
2005. *Decussoloculina barbui* Neagu: Olszewska, p. 37, pl. VI, figs 4, 5.

Remarks. Transversal sections show “X” shaped arrangement of four chambers in one whorl what results in somewhat irregular outline of the test.
Range. Middle Tithonian–Valanginian.
Occurrence. Sections: KA, KC, KD, KL, KO.

Genus *Quinqueloculina* d’Orbigny, 1826

Quinqueloculina semisphaeroidalis Danitch, 1971
Fig. 7H

1971. *Quinqueloculina semisphaeroidalis* n.sp.: Danitch, In: Romanov & Danitch, p. 144-145, pl. 39, figs 1-4.

Remarks. Transversal sections show almost circular outline of the test and a “Y” mode arrangement of chambers and relatively thick walls.
Range. Late Oxfordian–Tithonian.
Occurrence. Sections: KA, KE, KG, KK, KL, KO.

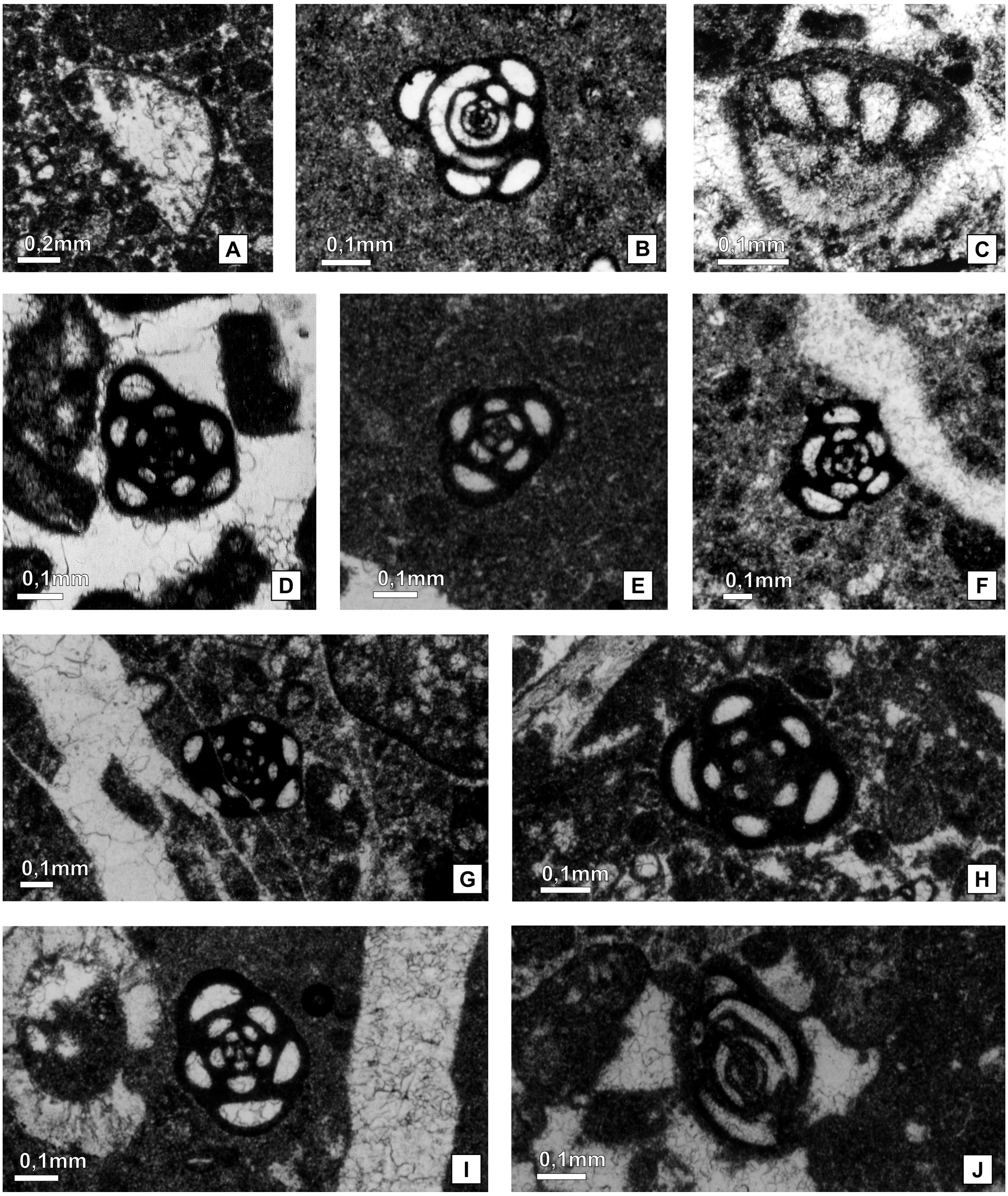

Fig. 7. **A** – *Neotrocholina molesta* (Gorbatchik) (KC 25a); **B** – *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti) (KO 3a); **C** – *Protopeneroplis utragranulata* (Gorbatchik) (KC 4a); **D** – *Decussoloculina barbui* Neagu (KC 41a); **E** – *Rumanoloculina mitchurini* (Dain) (KA 5a); **F** – *Quinqueloculina stellata* Matsieva & Temirbekova (KR 13a); **G** – *Scythiloculina confusa* Neagu (KB 17a); **H** – *Quinqueloculina semisphaeroidalis* Danitsch (KB 28a); **I**, **J** – *Rumanoloculina verbizhiensis* (Dulub) (KB 30a)

Quinqueloculina stellata Matsieva & Temirbekova, 1989
Fig. 7F

1989. *Quinqueloculina stellata* n.sp.: Matsieva & Temirbekova, p. 115, pl. 1, figs d, z, e.

Remarks. Transversal sections show "Y" mode of chamber arrangement and double projections at outer walls of chambers of the last whorl that mark ribs running along the test.
Range. Tithonian–Early Berriasian.
Occurrence. Sections: KB, KC, KE, KF, KR.

Genus *Rumanoloculina* Neagu, 1986

Rumanoloculina mitchurini (Dain, 1971)
Fig. 7E

1971. *Quinqueloculina mitchurini* n.sp.: Dain, In: Dain & Kuznetsova p. 114-115, pl. 1, figs 9, 10.
1989. *Quinqueloculina mitchurini* Dain: Matsieva & Temirbekova, p. 115, pl. 1, figs a-g.

Remarks. Transversal section shows "Y" mode of chamber ar-

rangement and triangular but rounded outline of the test. Similar features of the transversal section display *Quinqueloculina jurassica* Bielecka & Styk from the Late Oxfordian–Early Kimmeridgian of Poland and *Quinqueloculina podlubiensis* Tereshuk from the Kimmeridgian–Tithonian sediments of the Western Ukraine. The authors of both above mentioned species relate them to the *Quinqueloculina* sp. A and *Quinqueloculina* sp. B reported by Cushman & Glazewski (1949) from the Tithonian Nizhniov limestone of the Western Ukraine. More detailed investigations are necessary to solve the problem.
Range. Tithonian–Berriasian.
Occurrence. Sections: KA, KB, KC, KD, KG, KJ, KK, KN, KO, KR.

Rumanoloculina verbizhizhiensis (Dulub, 1964)
Fig. 7I, J

1964. *Quinqueloculina verbizhiensis* n.sp.: Dulub, p. 108, pl. 1, figs 3, 4.
1989. *Quinqueloculina verbizhiensis* Dulub: Matsieva & Temirbekova, p. 115, 117. pl. 1, figs z, c, k.

Remarks. Transversal section shows a quinqueloculine chamber arrangement and oval outline of the test. Axial sections show three sets of chambers making the whole test.
Range. Kimmeridgian–Tithonian.
Occurrence. Sections: KA, KB, KE, KF, KG.

Genus *Scythiloculina* Neagu, 1984

Scythiloculina confusa Neagu, 1984.
Fig. 7G

1984a. *Scythiloculina confusa* n.sp.: Neagu, pl. 1, figs 1-8, 16.
1984b. *Scythiloculina confusa* Neagu: Neagu, p. 205, 206 pl. 4, figs 10-37, text-fig.1.
2005. *Scythiloculina confusa* Neagu: Olszewska, p. 38, pl. VI, figs 9, 10.

Remarks. Transversal section show "Y" type of chamber arrangement in numerous whorls what makes outline of the test almost circular.
Range. Late Berriasian–Valanginian.
Occurrence. Sections. KB, KN, KR.

Suborder Rotaliina Delage & Herouard, 1896
Family Discorbidae Ehrenberg, 1838
Genus *Mohlerina* Bucur, Senowbari-Daryan & Abate, 1996

Mohlerina basiliensis (Mohler, 1938)
Fig. 8A

1938. *Conicospirillina basiliensis* n.sp.: Mohler, p. 27, pl. 27, 28; pl. 4, fig. 5.
1984. "*Conicospirillina*" *basiliensis* Mohler: Bernier, p. 525-526, pl. 21, fig. 3.
1991. *"Conicospirillina" basiliensis* Mohler: Altiner, pl. 3, figs 8, 9.
1996. *Mohlerina basiliensis* (Mohler): Bucur, Senowbari-Daryan & Abate, p. 70-74, pl. 3, figs 3-6; pl. 4, figs 2, 3, 5-9.
1999. *Mohlerina basiliensis* (Mohler): Schlagintweit & Ebli, p. 400, pl. 6, figs 1-2.
2005. *Mohlerina basiliensis* (Mohler): Olszewska, p. 38, pl. 6, fig. 1.

Remarks. Diversely oriented sections show typical for the species trochospiral mode of coiling and a two layered wals: inner-dark and microgranular, outer-clear, hyaline.
Range. Oxfordian–Valanginian.
Occurrence. Sections: KA, KB, KC, KD, KE, KJ, KK, KL, KN, KR.

Suborder Globigerinina Delage & Herouard, 1896
Family Globuligerinidae Loeblich & Tappan, 1884
Genus *Globuligerina* Bignot & Guyader, 1971

Globuligerina terquemi (Iovcheva & Trifonova 1961)
Fig. 8C

1961. *Globigerina terquemi* n.sp.: Iovcheva & Trifonova, p. 344-345, pl. II, figs 9-14.

Remarks. Horizontal sections of this small species show characteristic loose arrangement of chambers of the last whorl, while the axial sections reveal two whorls of chambers arranged in a low spire. Forms mentioned by Kuznetsova (In: Kuznetsova & Uspenskaya, 1980) as *Globuligerina* exgr*terquemi* (Iovcheva & Trifonova) and later described as *Globuligerina parva* n.sp. (In: Kuznetsova & Gorbatchik, 1985) from the Early Kimmeridgian of Crimea probably belong to the species.
Range. Kimmeridgian–Tithonian
Occurrence. Section KP.

CALCAREOUS DINOCYSTS

(systematics after Řehánek & Cecca, 1993)

Order Peridiniales Haeckel, 1894
Family Calciodinellaceae Deflandre, 1947 emend. Bujak & Davies, 1983
Genus *Comittosphaera* Řehánek, 1985

Comittosphaera sublapidosa (Vogler, 1941)
Fig. 8F

1941. *Cadosina sublapidosa* n.sp.: Vogler, p. 280, pl. 2, fig. 5
1994. *Comittosphaera sublapidosa* (Vogler): Ivanova, p.99, 100, pl 2, figs 9,10.
2005. *Comittosphaera sublapidosa* (Vogler): Olszewska, p. 31, pl. 3, fig. 7

Remarks. Spherical cyst with a two layered wall. The inner layer of variable thickness is composed of the microcrystalline calcite. The outer layer, vitreous in transmitted light is composed of the irregular, fine calcite crystals.
Range. Tithonian–Hauterivian.
Occurrence. Section KP.

Genus *Cadosina* Wanner, 1940

Cadosina parvula Nagy, 1966
Fig. 8G

1966. *Cadosina parvula* n.sp.: Nagy, p. 93, pl. 5, fig. 17
1993. *Cadosina parvula* Nagy: Řehánek & Cecca, p. 155, pl. 1, fig. 12, text-fig. 6A.

Remarks. Sphaerical cyst with a one layered wall composed of microcrystalline calcite. Differs from *Cadosina fusca* Wanner in smaller size and optimal distribution in the Late Oxfordian–Kimmeridgian.
Range. Late Oxfordian–Tithonian.
Occurrence. Section KB

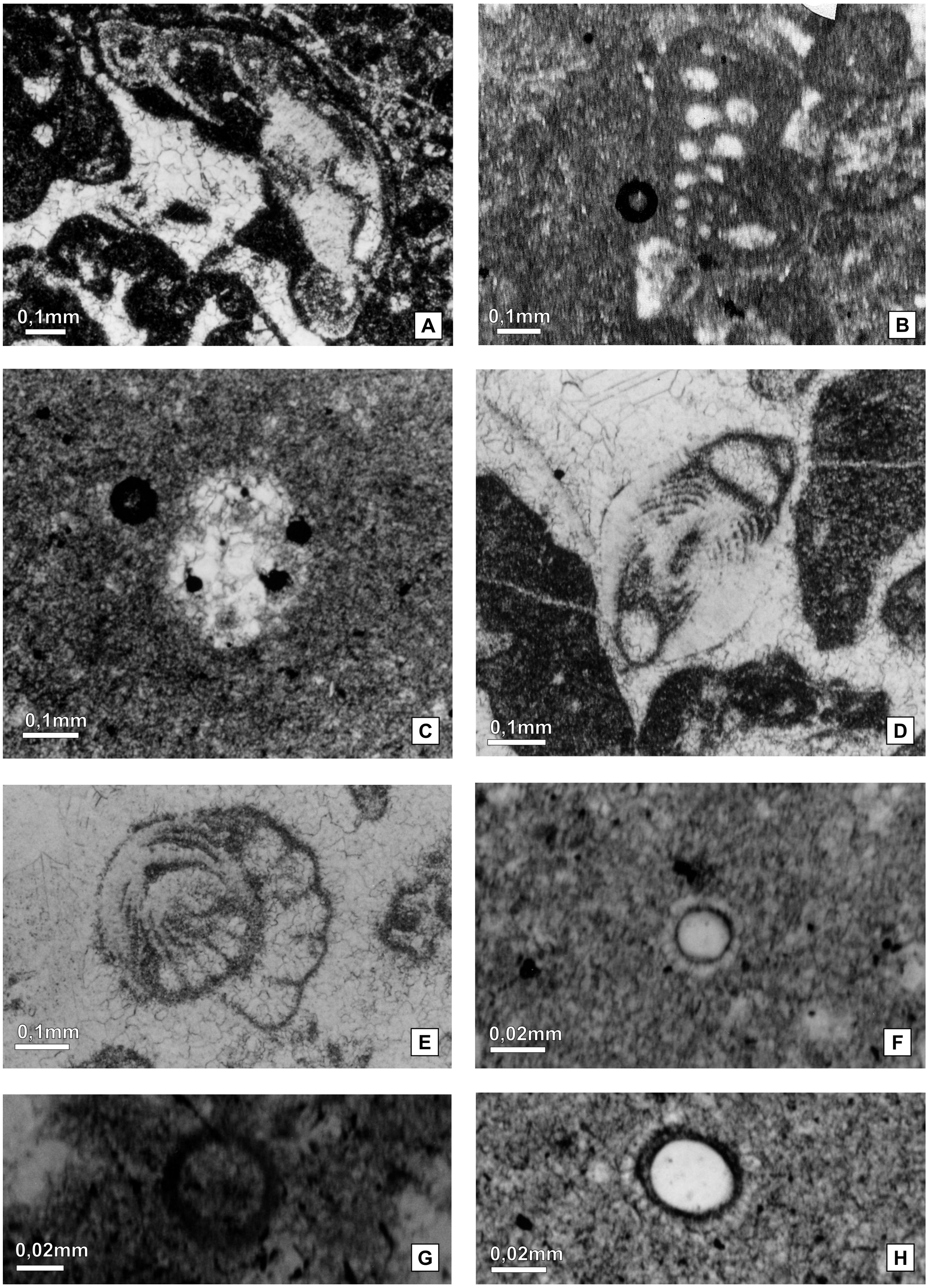

Fig. 8. **A** – *Mohlerina basiliensis* (Mohler) (KC 14a); **B** – *Verneuilinoides polonicus* (Cushman & Glazewski) (KD 3); **C** – *Globuligerina terquemi* (Iovcheva & Trifonova) (KP 5a); **D**, **E** – *Protopeneroplis striata* Weynschenk (KB 2a); **F** – *Comittosphaera sublapidosa* (Vogler) (KP 4a); **G** – *Cadosina parvula* Nagy (KB 14a); **H** – *Crustocadosina semiradiata* (Wanner) (KL 1)

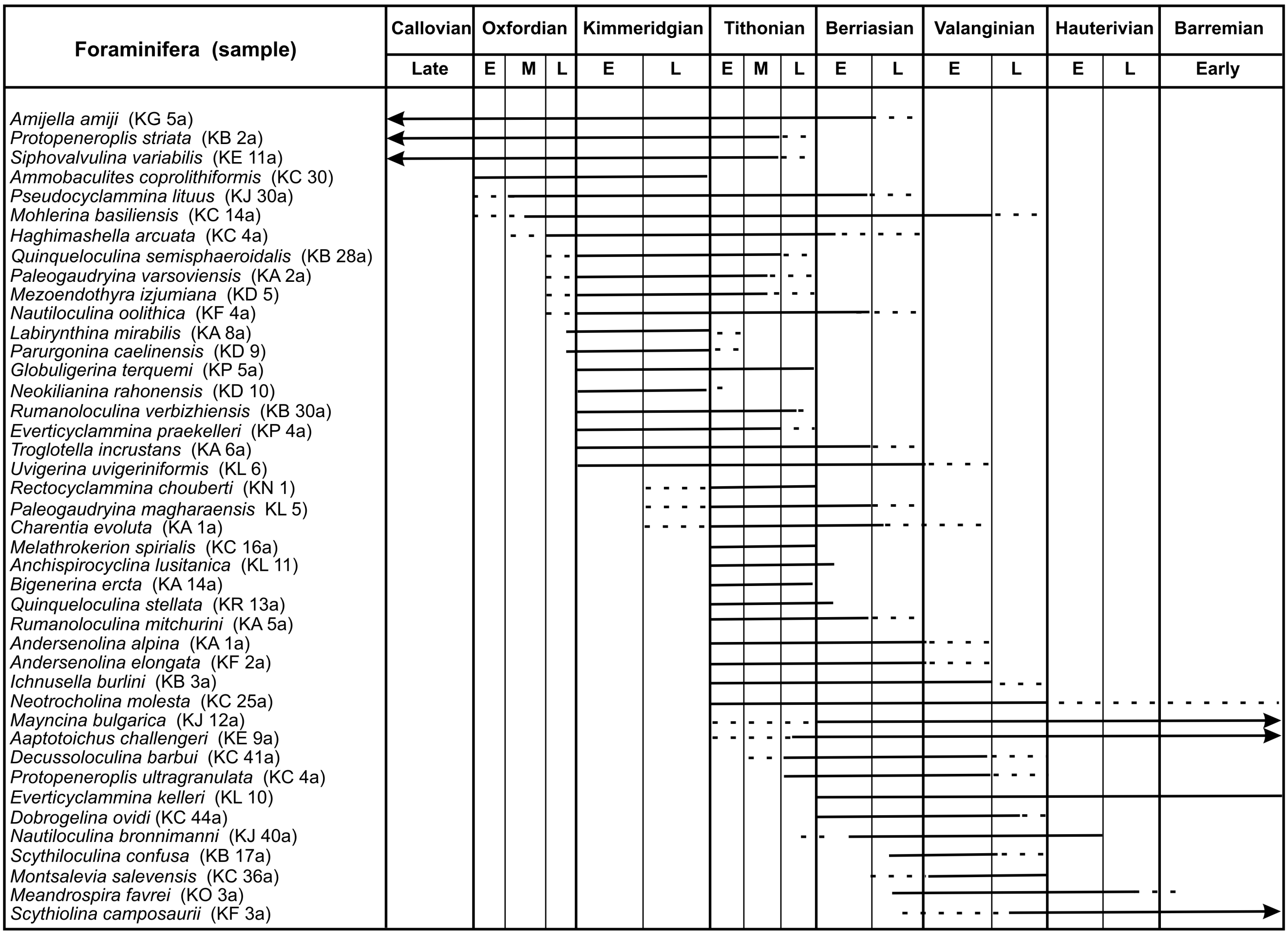

Fig. 9. Stratigraphic ranges of foraminifers from investigated area presented in Figs 4–8. For localization see Fig. 3

Genus *Crustocadosina* Řehánek, 1985

Crustocadosina semiradiata (Wanner, 1940)
Fig. 8H

1940. *Cadosina semiradiata* n.sp.: Wanner, p. 81, figs 36, 37.
1994. *Crustocadosina semiradiata* (Wanner): Ivanova, p. 89, 90 pl. I, figs 8, 9.
2005. *Crustocadosina semiradiata* (Wanner): Olszewska, p. 33, pl. 2, fig. 1.

Remarks. Spherical to oval cyst with two layered walls. The inner dark, microgranular layer has thickness equal to larger than the thickness of the outer, white, radial layer.
Range. Late Oxfordian–Early Albian.
Occurrence. Section KL.

REMARKS ON STRATIGRAPHY

Foraminiferal assemblages from the Aj-Petri and Yalta Yaila contain many species of small and large foraminifera of the recognised stratigraphical value for Jurassic carbonate sediments (Fig. 9). Among the large forms, *Labirynthina mirabilis* Weynschenk, *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano and *Neokilianina rahonensis* (Foury & Vincent) are known predominantly from the Kimmeridgian of the Mediterranean Tethys (Bassoulet, 1997). In the same area species *Anchispirocyclina lusitanica* (Egger) characterises the Tithonian strata (Bassoulet, 1997; Darga & Schlagintweit, 1991). In the Central and NW Crimea *Anchispirocyclina lusitanica* (Egger) is present in both Tithonian and Berriasian strata (Voloshina, 1977; Gorbatchik & Mohamad, 1997; Zhabina, 1989). Interesting is the persistent presence in the material studied the long lasting (Liassic–Berriasian) *Amijella amiji* (Henson) common in Tithonian strata of the Alpino-Crimean segment of the Tethys (Voloshina, 1977; Schlagintweit, 1991; authors' observations). The species also constitutes an index taxon for the lower Berriasian "beds with Bramkampella" reported by Gorbatchik and Mohamad (1997) from the Crimea.

In the upper part of the Tithonian species *Protopeneroplis ultragranulata* (Gorbatchik) makes its first appearance; being frequently used as an index taxon for the Early Berriasian of the northern margin of the Tethys (Azema *et al.*, 1977; Bassoulet & Fourcade, 1979; Kuznetsova & Gorbatchik, 1985; Sotak in Vašiček *et al.*, 1994; Gorbatchik & Mohamad, 1997). The Early Cretaceous age of the topmost part of the investigated profiles is also suggested by the appearance of such species, as: *Everticyclammina kelleri* (Henson), *Nautiloculina bronnimanni* Arnaud-Vanneau & Peybernès, *Montsalevia salevensis* (Charollais, Brönnimann & Zaninetti) or *Scythiolina camposaurii* (Sartoni & Crescenti), and *Mayncina bulgarica* Laug, Peybernès & Rey.

Palaeoenvironmetal, rather than stratigraphic, significance have the occurrence of abundant "trocholinas" and miliolids in Tithonian part of the Aj-Petri carbonates and Yalta Yaila. Development of both groups (known also from the Alpino-Carpathian realm and Moesian Platform) may be attributed to seasonal variations of sea level during the stage.

To sum up, one may conclude that stratigraphic ranges of characteristic species of foraminifera (cf. Fig. 9) identified in the investigated samples suggest the Kimmeridgian to Berriasian age for the Aj-Petri and Yalta Yaila carbonates.

Correlation of the thin-plate assemblages obtained from the indurated carbonates with those from the water-processed soft sediments of the same region (*vide* Kuznetsova & Gorbatchik, 1985) is somewhat difficult. The latter do not reflect neither spatial nor temporal original distribution of taxons in the rock. They also reflect different sedimentary regime.

REMARKS ON PALAEOENVIRONMENT AND PALAEOBIOGEOGRAPHY OF FORAMINIFERA

Flügel in his fundamental work (Flügel, 2004, p. 660) states that "carbonate platforms are dynamic systems that change through time and space". The rightness of the statement is confirmed also by changes in foraminiferal assemblages of the investigated area. The Kimmeridgian–Tithonian assemblages are predominantly made of the internal platform genera such as: *Pseudocyclammina*, *Everticyclammina*, *Rectocyclammina*, *Parurgonina*, *Anchispirocyclina*, *Amijella* or *Neokilianina*, and *Miliolidae* (Septfontaine, 1980; Pélissié, Peybernès & Rey, 1984). The Early Cretaceous assemblages contain more outer platform elements, such as "trocholinas", and genera: *Mohlerina*, *Protopeneroplis*, *Charentia*, *Montsalevia* (Chioccini *et al.*, 1988).

Known palaeogeographic occurrences of many of Aj-Petri and Yalta Yaila foraminifera indicate that they belong to cosmopolitan forms connected predominatly with the north Tethyan shelves during the end of Jurassic and the early Cretaceous (Pélissié *et al.*, 1982; Bassoulet *et al.*, 1985; Arnaud-Vanneau, 1986).

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