Annales Societatis Geologorum Poloniae (2007), vol. 77: 291–311.

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

Marcin KRAJEWSKI[1] & Barbara OLSZEWSKA[2]

[1] *AGH University of Science and Technology, al. Mickiewicza 30, 30-059 Kraków, Poland; e-mail: kramar@geolog.geol.agh.edu.pl*

[2] *Polish Geological Institute Carpathian Branch, ul. Skrzatów 1, 31-560 Kraków, Poland; e-mail: barbara.olszewska@pgi.gov.pl.*

Krajewski, M. & Olszewska, B., 2007. Foraminifera from the Late Jurassic and Early Cretaceous carbonate platform facies of the southern part of the Crimea Mountains, Southern Ukraine. *Annales Societatis Geologorum Poloniae*, 77: 291–311.

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.

Manucript received 9 July 2007, accepted 17 December 2007

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

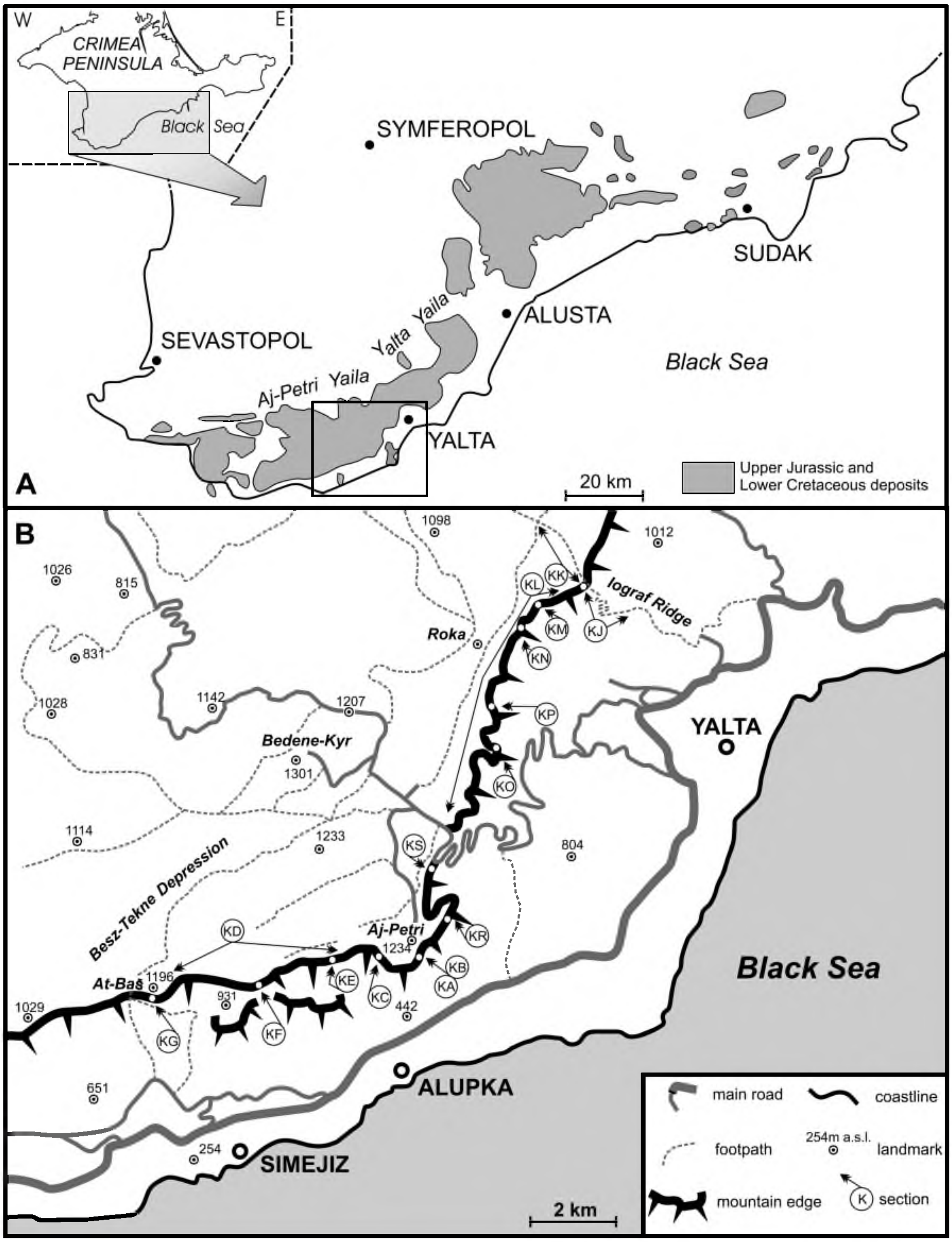

Fig. 1 Location of the study area. **A.** Upper Jurassic–Lower Cretaceous deposits in the Crimea Mountains; after Yudin 2001, simplified. **B.** Location of sections between Iograf Ridge and At-Baś Mountain

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)

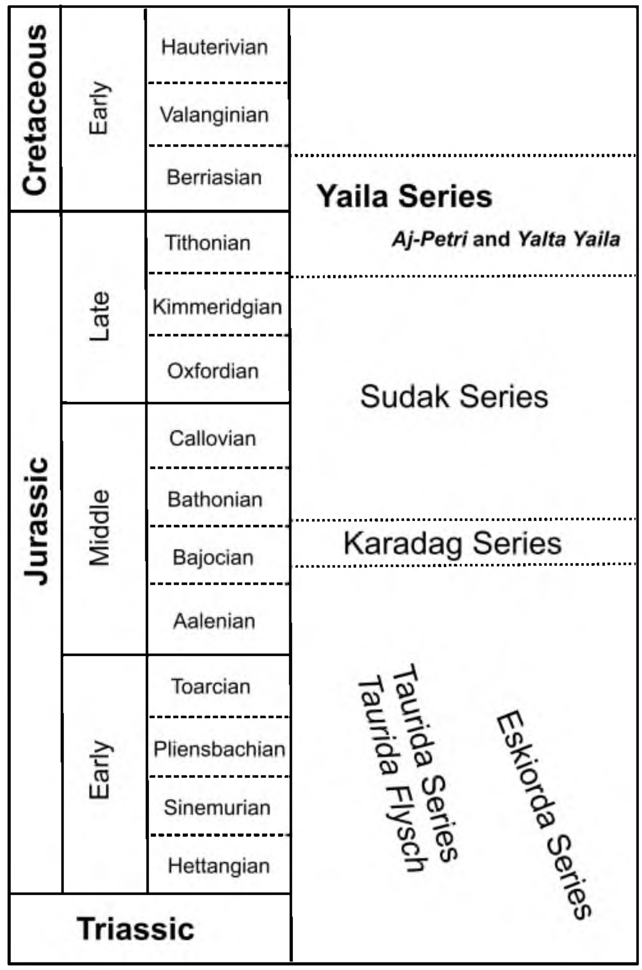

Fig. 2. General stratigraphy of the Crimea Mountains after Mileev *et al.*, 2006; modified

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.

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*,

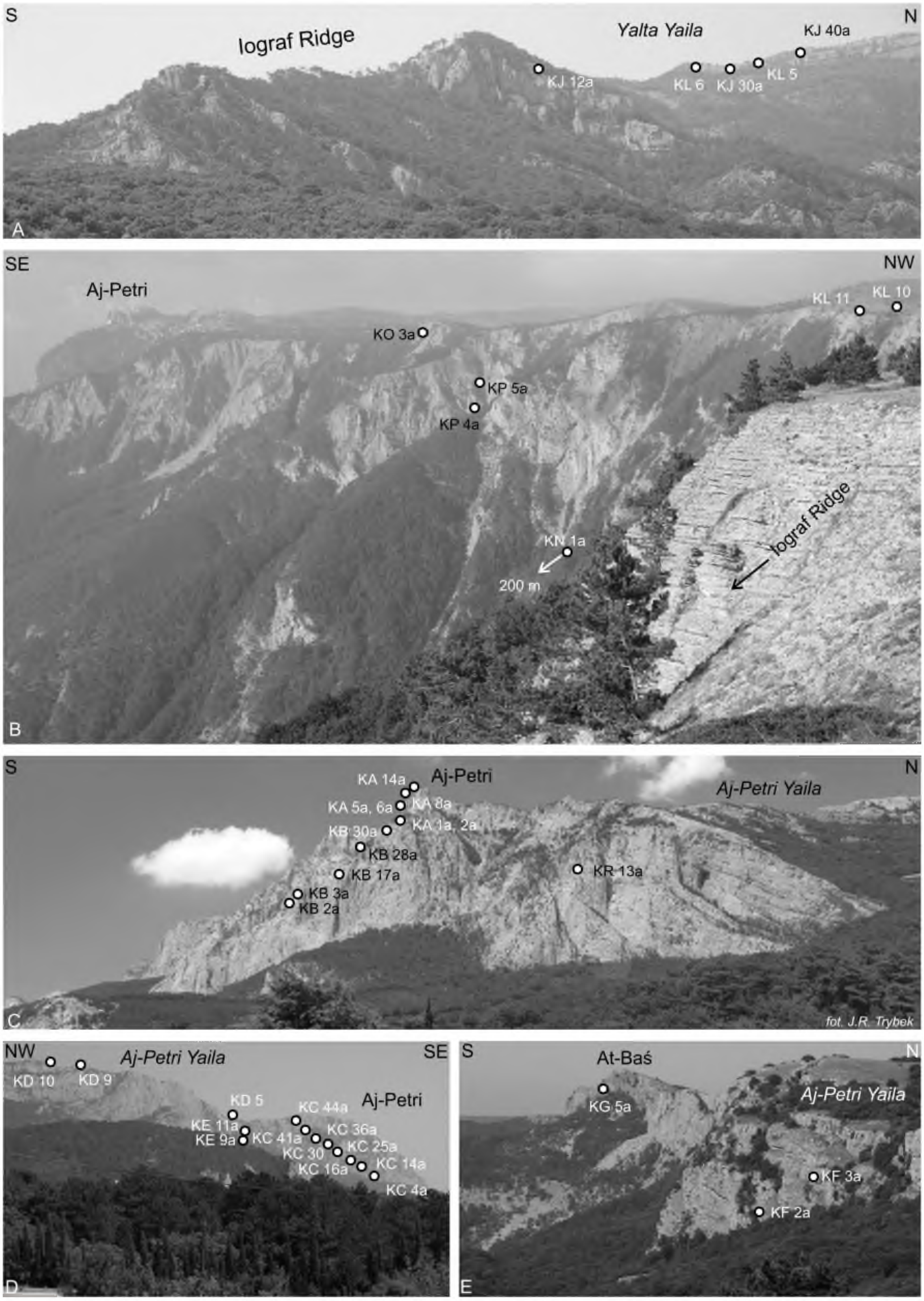

Fig. 3. The southern escarpment of the Yalta and Aj-Petri Yaila with location of the samples presented in Figs 4–9

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.

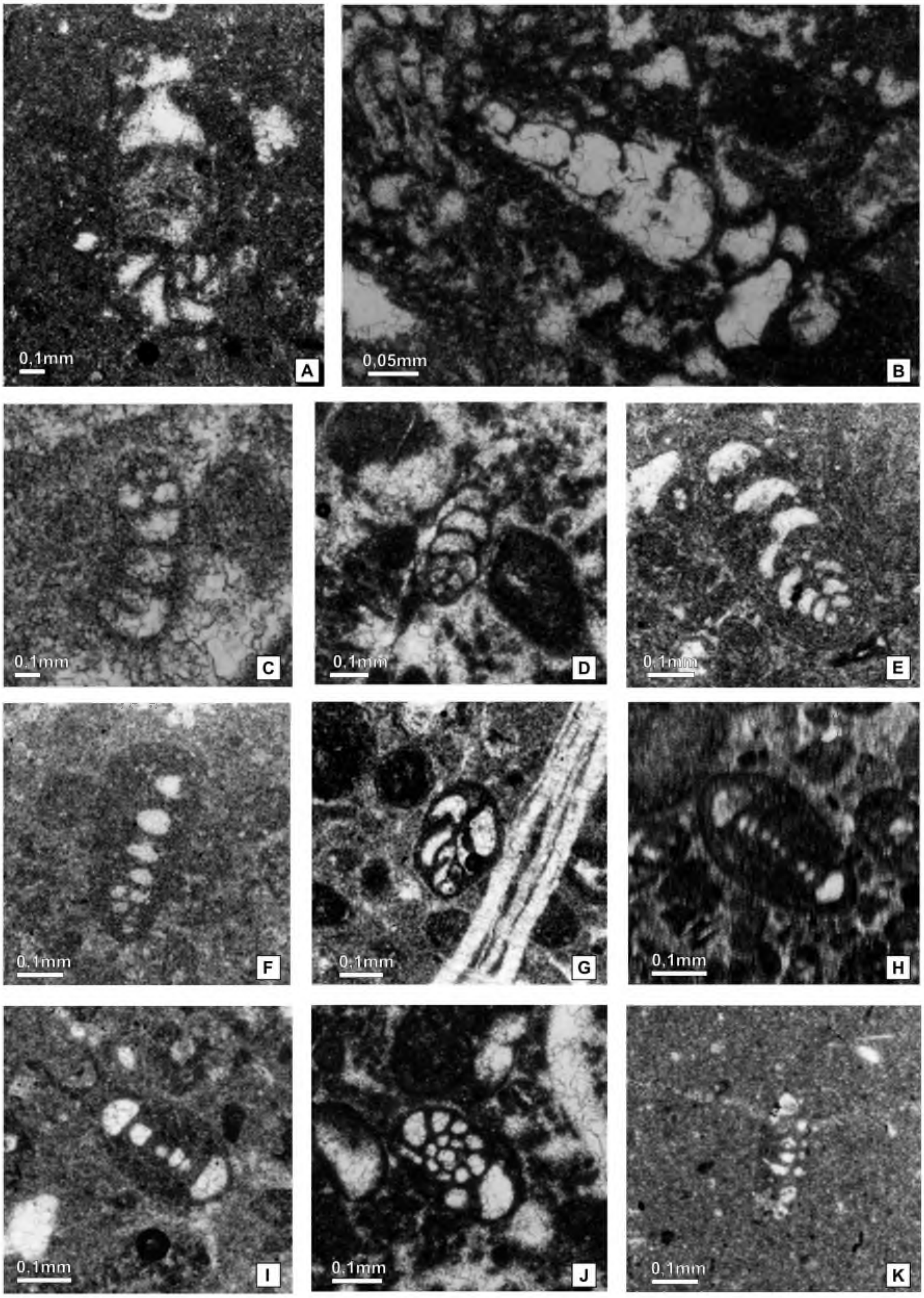

Fig. 4. **A** – *Ammobaculites coprolithiformis* (Schwager), (KC 30a); **B** – *Troglotella incrustans* Wernli & Fookes, (KA-6a); **C** – *Aaptotoichus challengeri* Holbourn & Kaminski, (KE 9a); **D** – *Haghimashella arcuata* (Haeusler), (KC 4a); **E** – *Paleogaudryina magharaensis* Said & Bakarat, (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. 12, 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,

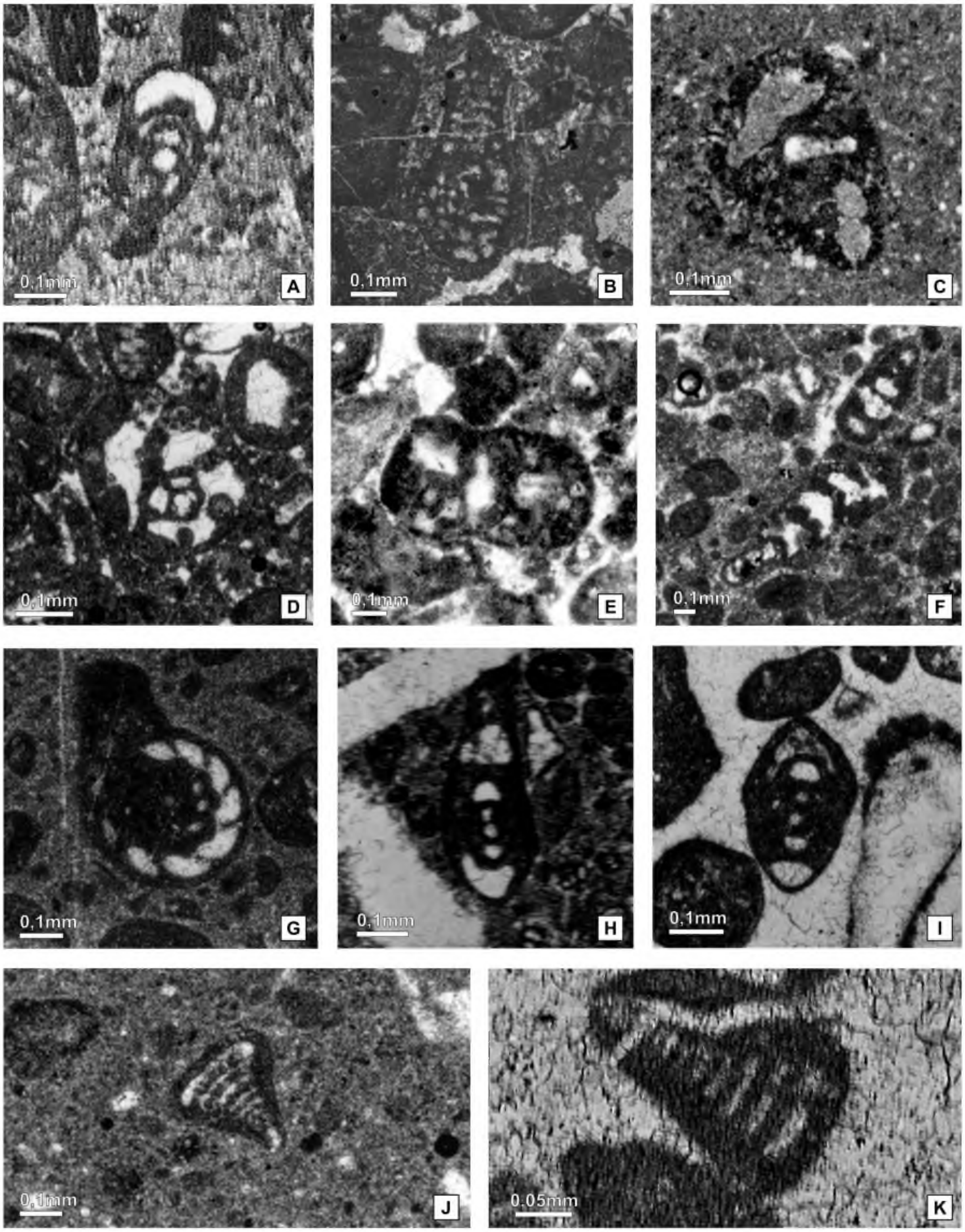

Fig. 5. **A** – *Mesoendothyra izjumiana* Dain, (KD 5); **B** – *Labirynthina mirabilis* Weynschenk, (KA 8a); **C**, **D** – *Everticyclammina praekelleri* Redmond (KP 4a); **E** – *Everticyclammina kelleri* Henson (KL 10); **F** – *Rectocyclammina chouberti* Hottinger (KN 1a); **G**, **H** – *Charentia 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.

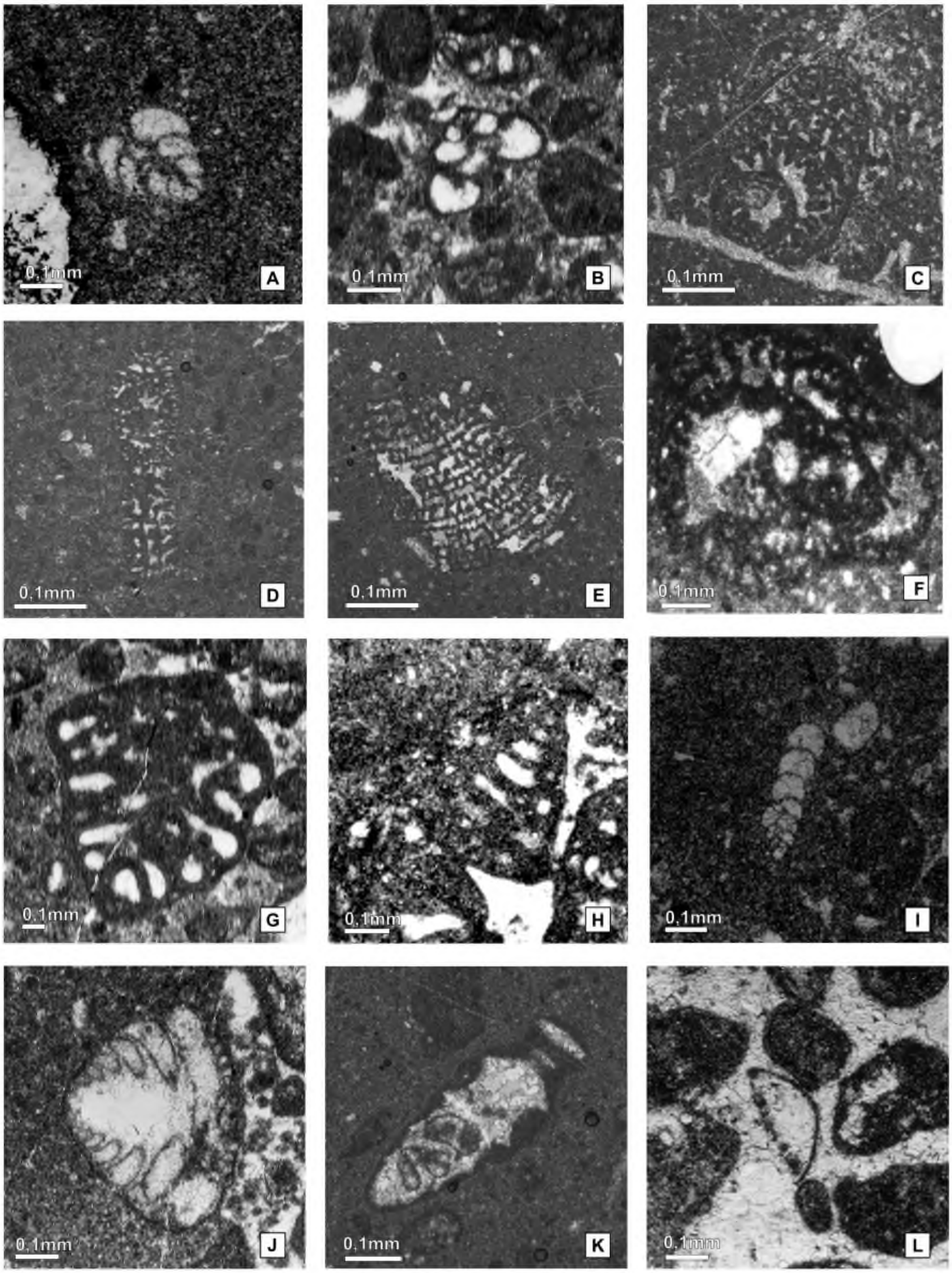

Fig. 6. **A** – *Siphovalvulina variabilis* Septfontaine (KE 11a); **B** – *Dobrogelina ovidi* Neagu (KC 44a); **C** – *Amijella amiji* (Henson) (KG 5a); **D**, **E** – *Anchispirocyclina lusitanica* (Egger) (KL 11); **F** – *Pseudocyclammina lituus* (Yokoyama) (KJ 30a); **G** – *Parurgonina caelinensis* 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.

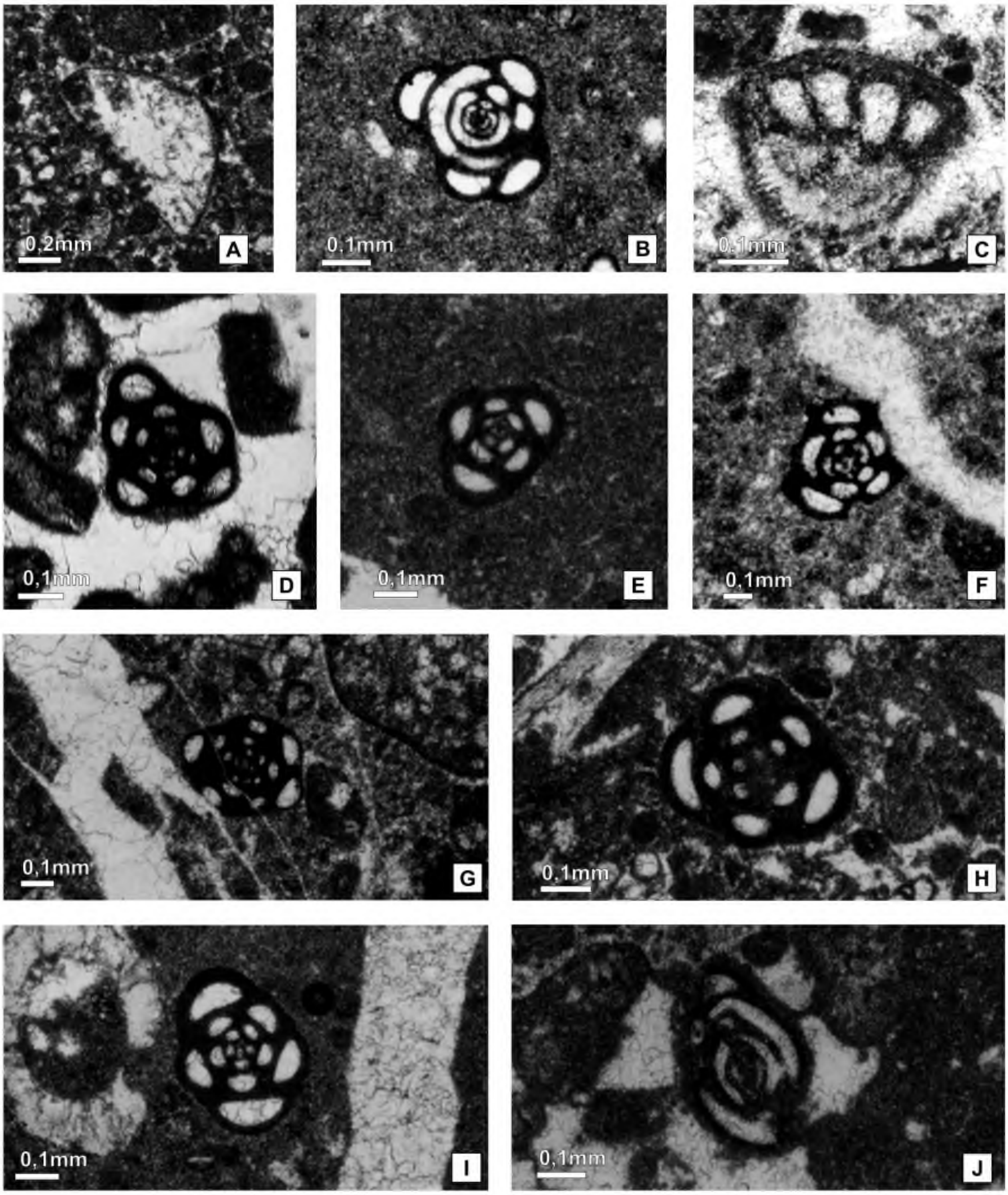

Fig. 7. **A** – *Neotrocholina molesta* (Gorbatchik) (KC 25a); **B** – *Meandrospira favrei* (Charollais, Brönnimann & Zaninetti) (KO 3a); **C** – *Protopeneroplis utragranulata* (Gorbatchik) (KC 4a); **D** – *Decussoloculina barbui* Neagu (KC 41a); **E** – *Rumanoloculina mitchurini* (Dain) (KA 5a); **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

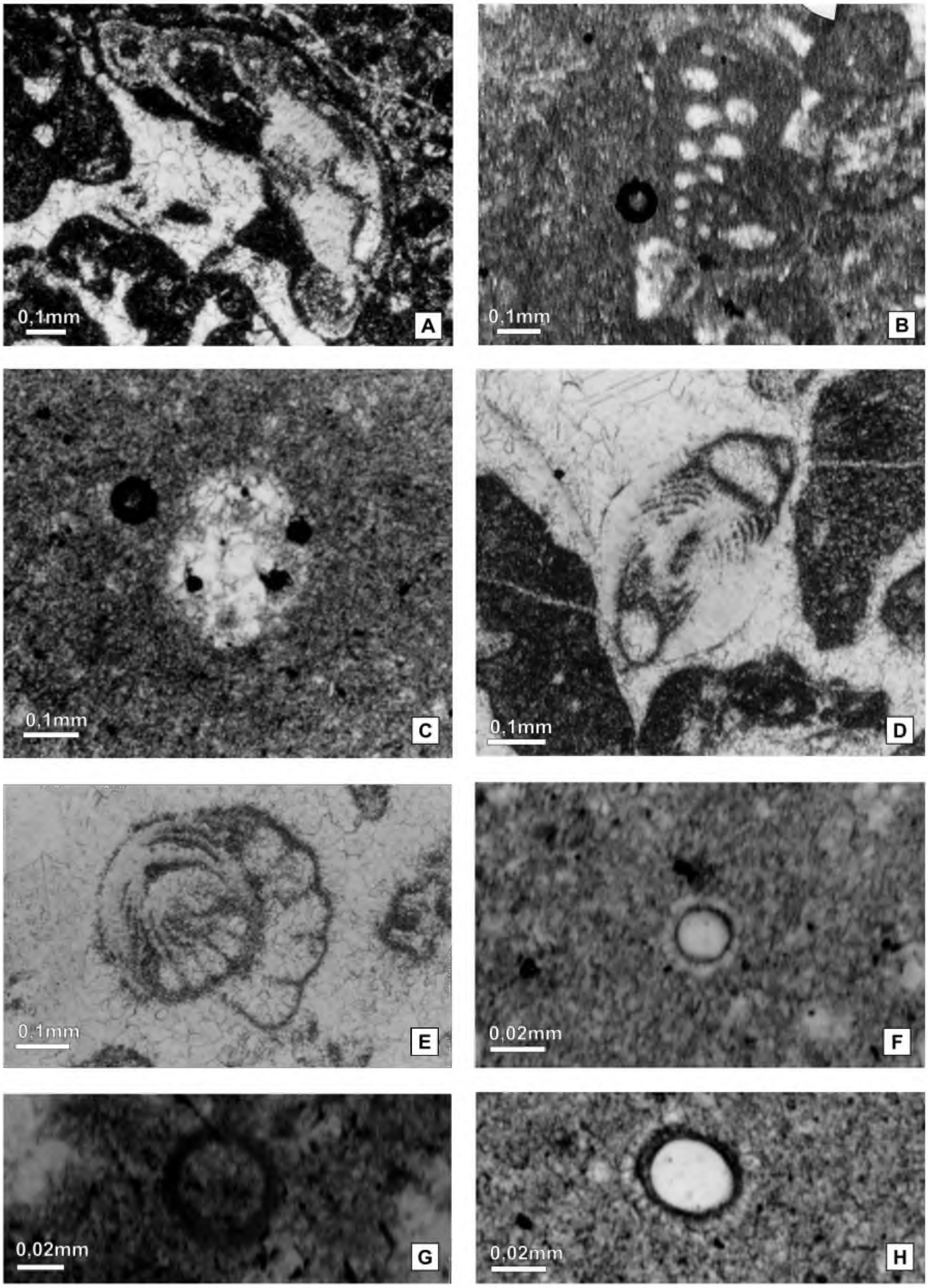

Fig. 8. **A** – *Mohlerina basiliensis* (Mohler) (KC 14a); **B** – *Verneuilinoides polonicus* (Cushman & Glazewski) (KD 3); **C** – *Globuligerina terquemi* (Iovcheva & Trifonova) (KP 5a); **D**, **E** – *Protopeneroplis striata* Weynschenk (KB 2a); **F** – *Comittosphaera sublapidosa* (Vogler) (KP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

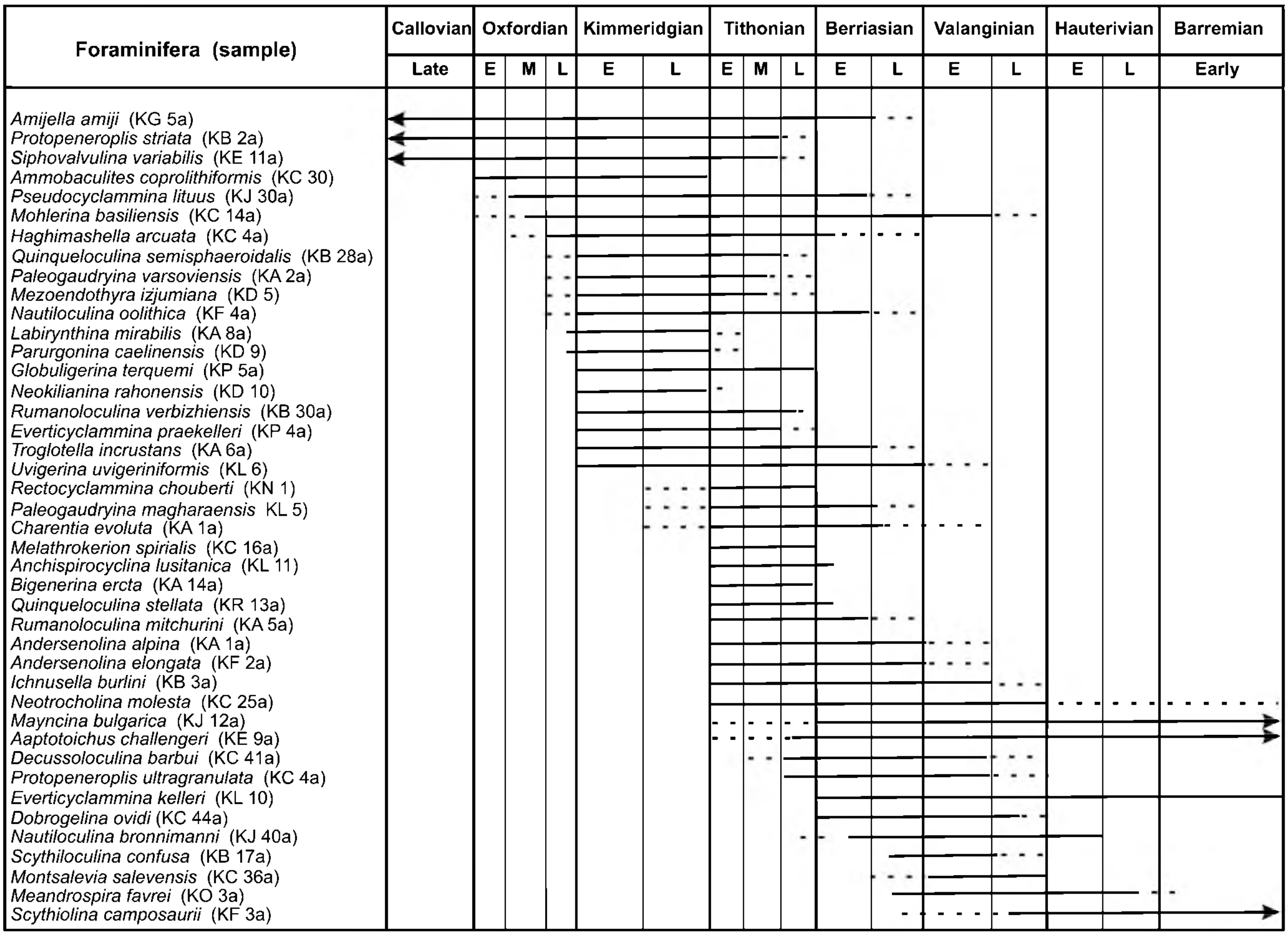

Fig. 9. Stratigraphic ranges of foraminifers from investigated area presented in Figs 4–8. For localization see Fig. 3

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).

Acknowledgements

The authors thank the reviewers J. Smoleń (PIG Warsaw) and J. Tyszka (ING PAN Kraków) for theirs suggestions; B. M. Romanyuk (Lviv National University), M.A. Rogov (Geological Institute of RAS, Moscow), V. V. Yudin (Ukr. Min. Resources State Inst. Simferopol) and J. Matyszkiewicz (AGH, Kraków) for help in literature collection and discussions. This research was financed by the AGH grants no. 10.10.140.463 and 11.11.140.560.

REFERENCES

Altiner, D., 1991. Microfossil biostratigraphy (mainly Foraminifera) of the Jurassic–Lower Cretaceous carbonate successions in North-Western Anatolia (Turkey). *Geologia Romana*, 27: 167–213.

Arnaud-Vanneau, A., 1986. Variations dans la composition et dans la diversité des faunes de Foraminifères benthiques du Crétacé inférieur sur quelques plate-formes carbonatées téthysiennes de l'Europe et du moyen-Orient. *Bulletin de la Société Géologique* de *France* (8), II: 245–253.

Arnaud-Vanneau, A., Boisseau, T. & Darsac, C., 1988. Le genre *Trocholina* Paalzow, 1922 et ses principales espèces au Crétacé. *Revue de Paléobiologie*, Volume Spécial 2: 353–377.

Arnaud-Vanneau, A. & Masse, J. P., 1989. Les Foraminifères benthiques des formations carbonatées de l'Hauterivien–Barrémien pro parte du Jura Vaudois et Neuchâtelois (Suisse). *Mémoires de la Société neuchâteloise des sciences naturelles*, 11: 257–276.

Arnaud-Vanneau, A. & Peybernès, B., 1978. Les représentants éocretacés du genre *Nautiloculina* Mohler, 1938 (*Foraminifera*, *Fam. Lituolidae* ?) dans les chaines subalpines septentrionales (Vercors) et les Pyrénées franco-espgnoles. *Géobios*, 11: 67–81.

Azéma, J., Chabrier, G., Fourcade, E. & Jafrezzo, M., 1977. Nouvelles données micropaléontologiques, stratigraphiques et paléogéographiques sur le Portlandien et le Néocomien de Sardaigne. *Revue de Micropaléontologie*, 20: 125–139.

Banner, F. T. & Highton, J., 1990. On *Everticyclammina* Redmond (Foraminifera), especially *E. kelleri* (Henson). *Journal* of *Micropaleontology*, 9: 1–14.

Barnard, T., Cordey, W. G. & Shipp, D. J., 1981. Foraminifera from the Oxford Clay (Callovian–Oxfordian of England). *Revista Española de Micropalentología*, 13: 383–462.

Barwicz-Piskorz, W., 1995. Zespoły otwornic i stratygrafia górnej jury obrzeżenia Gór Świętokrzyskich. (English summary). *AGH Rozprawy-Monografie*, 21: 1–120.

Bassoulet, J. P., 1997. Les Grandes Foraminifères. In: Cariou, E. & Hantzpergue, P. (eds.), *Biostratigraphie du Jurassique Ouest-Européen et Mediterranén*. ELF Ep Mémoire, 17: 293–304.

Bassoulet, J. P. & Fourcade, E., 1979. Essai de synthèse de répartition de Foraminifères benthiques du Jurassique carbonaté mésogéen. *Compte Rendu Sommaire des Séances de la Société Géologique de France*, 2: 69–71.

Bassoulet, J. P., Fourcade, E. & Peybernès, B., 1985. Paléobiogéographie des grands Foraminifères benthiques des marges néo-téthysiennes au Jurassique et au Crétacé inférieur. *Bulletin de la Société Géologique* de *France* (8), I: 699–713.

Bernier, P., 1984. Les formations carbonatées du Kimméridgien et du Portlandien dans le Jura Méridional. *Documents des Laboratoires de Géologie Lyon*, 92: 445–803.

Bielecka, W., 1980. Rząd Foraminiferida Eichwald. (In Polish).

In: Malinowska, L. (ed.), *Budowa geologiczna Polski. Atlas skamieniałości przewodnich i charakterystycznych. Część 2 b, Mezozoik, Jura*. Wydawnictwa Geologiczne, Warszawa, 539 pp.

Bielecka, W. & Pożaryski, W., 1954. Stratygrafia mikropaleontologiczna górnego malmu w Polsce środkowej. (In Polish). *Instytut Geologiczny, Prace* 12: 1–72.

Brönnimann, P., 1967. Re-examination of the morphology of Nautiloculina oolithica Mohler, 1938. *Compte Rendue des Séances S.P.H.H.* Genève, 2: 48–61.

Bucur, I. I., Cociuba, I. & Cociuba, M., 1993. Microfacies and microfossils in the Upper Jurassic–Lower Cretaceous limestone in the southern part of the Padurea Craiului mountains. *Romanian Journal of Stratigraphy*, 75: 33–39.

Bucur, I. I., Senowbari-Daryan, B. & Abate, B., 1996. Remarks on some foraminifera from the Upper Jurassic (Tithonian) reef limestone of Madonie Mountains (Sicily). *Bolletino della Società Paleontologica Italiana*, 35: 65–80.

Bykova, N. K., Balakhmatova, V. T., Vassilenko, V. P., Voloshinova, N. A., Grigelis, A., Dain, L. G., Ivanova, L. V., Kuzina, V. I., Kuznetsova, Z. V., Kozyreva, B. F., Morozova, V. G., Myatliuk, E. V. & Subbotina, N. N., 1958. New genera and species of foraminifera. (In Russian). *Mikrofauna SSSR, Sbornik*, 9: 2–78.

Charollais, J., Brönnimann, P. & Zaninetti, L., 1966. Troisième note sur les foraminifères du Crétacé inférieur de la région genevoise. Remarques stratigraphiques et description de *Pseudotextulariella salevensis*, n.sp.; *Haplophragmoides joukowskyi*, n.sp.; *Citaella? favrei*, n.sp. *Archives des Sciences. Société de Physique et d' Histoire Naturelle de Genève*, 19: 23–48.

Chioccini, M., Mancinelli, A. & Marucci, C., 1988. Distribution of Benthic Foraminifera and Algae in the Latinum-Abruzzi Carbonate Platform Facies (Central Italy) During Upper Malm-Neocomian. *Revue de Paléobiologie*, Volume Spécial, 2: 219–227.

Cushman, J. A. & Glazewski, J., 1949. Upper Jurassic Foraminifera from the Nizniow Limestone of Podole, Poland. *Contribution from the Cushman Laboratory for Foraminiferal Research*, 25: 1–11.

Cuvillier, J., Foury, G. & Pignatti Morano, A., 1968. Foraminiferes Nouveaux du Jurassique superieur du Val Cellina (Frioul Occidental, Italie). *Geologia Romana*, VII: 141–156.

Dain, L. G. & Kuznetsova, K. I., 1977. Zonal subdivision of the stratotypical section of the Volgian Stage based on foraminifera. (In Russian, English summary). *Voprosy Mikropaleontologii*, 14: 103–123.

Darga, R. & Schlagintweit, F., 1991. Mikrofazies, Paläontologie und Stratigraphie der Lerchkogelkalke (Tithon–Berrias) des Dietrichshorns (Salzburger Land, Nördliche Kalkalpen). *Jahrbuch der Geologischen Bundes-Anstalt*, 134: 205–226.

Dragastan, O. N. & Richter, D. K., 2003. Calcareous algae and foraminifers from Neocomian limestones of Methana Peninsula, Asprovouni Mts. (Greece) and from South Dobrogea (Romania). *Analele Universitatii Bucureşti,. Geology, Special Publication*, 1: 58–79.

Dulub, V. G. & Tereshuk, A. S., 1964. Predstavitely miliolid iz jurskikh otlozheniy yugo-zapadnoy okrainy russkoy platformy i predkarpatskogo progiba. *Trudy Ukrainskoy NIGRI*, 9: 107–109.

Ebli, O. & Schlagintweit, F., 1998. On some biostratigraphically important microfossils (benthic foraminifera, dasycladales) from subsurface Late Jurassic–Early Cretaceous shallow water limestones of S.-Germany. *Mitteilungen der Bayerischen Staasslg. Paläontologie und historisches Geologie*, 38: 9–23.

Ellis, B. & Messina, A., 1941–2007. Catalogue of Foraminifera and Supplements. *Amer. Mus. Nat. Hist. Special Publication*. New York.

Foury, G. & Vincent, E., 1967. Morphologie et répartition stratigraphique du genre *Kilianina* Pfender (Foraminifère). *Eclogae geologicae Helvetiae*, 60: 33–45.

Flügel, E., 2004. *Microfacies of carbonate rocks*. Springer, Berlin, Heidelberg New York. 976 pp.

Fourcade, E. & Neumann, M., 1965. A propos des genres Labyrinthina Weynschenk, 1951 et Lituosepta Cati, 1959. *Revue de Micropaléontologie*, 8: 233–239.

Golonka, J., 2004. Plate tectonic evolution of the southern margin of Eurasia in the Mesozoic and Cenozoic. *Tectonophysics*, 381: 235–273.

Gorbatchik, T. N., 1959. Novye vidy foraminifer iz nizhnemelovykh otlozheniy Kryma i severo-zapadnogo Kavkaza. (In Russian). *Paleontologitcheskiy Zhurnal*, 1: 78–83.

Gorbatchik, T. N., 1971. K evolutsii ustia nekotorykh rannemelovykh lituolid. (In Russian). *Paleontologicheskiy Zhurnal*, 1: 113–116.

Gorbatchik, T. N. & Kuznetzova, K. H., 1994. Sravnienje tytonskikh foraminifer Kryma i Syrii. (In Russian). *Stratigrafia, Geołogiczeskaja Korelacja*, 2: 51–63.

Gorbatchik, T. N. & Mohamad, G. K., 1997. New species of Lituolida (Foraminifera) from the Tithonian and Berriasian of the Crimea. (In Russian, English summary). *Paleontologitcheskiy Zhurnal*, 4: 3–9.

Holbourn, A. E. L. & Kaminski, M. A., 1997. Lower Cretaceous deep-water foraminifera of the Indian Ocean. *Grzybowski Foundation Special Publication*, 4, pp. 172.

Hottinger, L., 1967. Foraminifères imperforés du Mesozoïque marocain. *Notes et Memoires du Service Géologique, Maroc*, 209: 3–129.

Iovcheva, P. & Trifonova, E., 1961. Tithonian *Globigerina* from North-West Bulgaria. (In Bulgarian, English summary). *Travaux sur la géologie de la Bulgarie*, ser. *Paléontologie*, 3: 343–345.

Ivanova, D., 1994. Cadosinidae Wanner, 1940 and Stomiosphaeridae Wanner, 1940 (Incertae sedis) from the Upper Jurassic of the Central Forebalkan, Bulgaria. *Geologia Balkanica*, 24: 85–102.

Ivanova, D. & Koleva-Rekalova, E., 2004. Agglutinated foraminifers in the framework of Southwestern Bulgarian palaeoenvironmental evolution during the late Jurassic and Early Cretaceous. In: Bubík, M. & Kaminski, M. A. (eds), *Proceedings of the Sixth International Workshop on Agglutinated Foraminifera. Grzybowski Foundation Special Publication*, 8: 217–227.

Ivanova, D. & Kołodziej, B., 2004. New foraminiferal data on the age of Stramberk-type limestones, Polish Carpathians. *Comptes rendus de l'Académie bulgare des Sciences*, 57: 69–74.

Kaminski, M. A. 2004. The year 2000 classification of the agglutinated foraminifera. In: Bubik, M. & Kaminski, M. A. (eds.), *Proceedings of the Fifth International Workshop on Agglutinated Foraminifera. Grzybowski Foundation Special Publication*, 8: 237–255.

Kobayashi, F. & Vuks, V. Ya., 2006. Tithonian–Berriasian foraminiferal fauna from the Torinosu-type calcareous blocks of the southern Kanto Mountains, Japan: their implications for postaccretionary tectonics of Jurassic to Cretaceous terranes. *Geobios*, 39: 833–843.

Krajewski, M. & Olszewska, B., 2006. New data about microfacies and stratigraphy of the Late Jurassic Aj-Petri carbonate buildup (SW Crimea Mountains, S Ukraine). *Neues Jahrbuch für Geologie und Paläontologie Monatshefte*, 5: 298–312.

Kuznetsova, K. I. & Gorbatchik, T. N., 1985. *Upper Jurassic and Lower Cretaceous Stratigraphy and Foraminifers of the Crimea*. (In Russian). Nauka. Moscow, 119 pp.

Kuznetsova, K. I. & Uspenskaya, E. A., 1980. Novye nahodki planktonnykh foraminifer v verkhnejurskikh otlozhenyakh Kryma. (In Russian). *Doklady Akademii Nauk SSSR*, 254: 748–751.

Leshukh, R., Permjakov, V. V. & Pouhtovicz, B. M., 1999. *Jurassic deposits of the southern Ukraine*. (In Ukrainian). Lviv 335 pp.

Loeblich, A. R. jr. & Tappan, H., 1988. *Foraminiferal genera and their classification*. Van Nostrand Reinhold C., N.Y., 715 pp.

Laug, B., Peybernes, B. & Rey, J., 1980. Mayncina bulgarica n.sp. Lituolidé nouveau du Crétacé inférieur Mésogéen (Bulgarie, Portugal, Pyrénées, Tunisie). *Bulletin de la Société d'Histoire Naturelle de Toulouse*, 116: 68–76.

Luperto Sinni, E. & Masse, J. P., 1984. Données nouvelles sur la micropaléontologie et la stratigraphie du "Calcare di Bari" (Cretacé inferieur) dans la region des Murges (Italie Méridionale). *Rivista Italiana di Paleontologia e Stratigrafia*, 90: 331–373.

Luperto Sinni, E. & Masse J. P., 1986. Données nouvelles sur la stratigraphie des calcaires de plate-forme du Cretacé inferieur du Gargano (Italie Méridionale). *Rivista Italiana di Paleontologia e Stratigrafia*, 92: 33–66.

Matsieva, T. V. & Temirbekova, U. T., 1989. Miliolidy Titona severo-vostochnogo Kavkaza. (In Russian). *Paleontologicheskiy Zhurnal*, 4: 114–118.

Mileev, V. S. & Baraboshkin, E. Yu., 1999. To the problem of fashion in interpretation of Crimea geologic history. (In Russian, English summary). *Bull. Soc. Natur. Moscow, ser. geol.*, 74: 29–37.

Mileev, V. S., Baraboshkin, E. Yu., Rozanov, S. B. & Rogov, M. A., 2006. Kimmerian and Alpine tectonics of Mountain Crimea. (In Russian, English summary). *Bull. Soc. Natur. Moscow, ser. geol.*, 81: 22–33.

Mohler, W., 1938. Mikropaläontologische Untersuchungen in nordschweizerischen Juraformation. *Abhandlungen der Schweizerische Paläontologische Gesellschaft*, 60: 1–53.

Neagu, T., 1984 a. Nouvelles données sur la morphologie du test, sur la systematique et la nomenclature des Miliolidés Agathistegues du Mésozoïque. *Revista Española de Micropaleontologia*, 16: 75–90.ñ

Neagu, T., 1984 b. Berriasian–Valanginian miliolid fauna of the Southern Dobrogea (Romania). *Revista Española de Micropaleontologia*, 17: 201–220.

Neagu, T., 1994. Early Cretaceous *Trocholina* group and some related genera from Romania. Part I. *Revista Española de Micropaleontologia*, 26: 117–143.

Neagu, T., 1995. The Cretaceous *Trocholina* group and some related genera from Romania. Part II. *Revista Española de Micropaleontologia*, 27: 5–40.

Neagu, T., 1997. Lower Cretaceous agglutinated foraminifera from the superfamilies Verneuilinacea and Ataxophragmiacea; Southern Dobrogea, Romania. *Annales Societatis Geologorum Poloniae*, 67: 307–323.

Neagu, T., 1999. Lower Cretaceous calcareous agglutinated foraminifera from the Southern Dobrogea-Romania, Part IV. Miscellanea (Lituolacea, Biokovinacea and Loftusiacea-some new taxa). *Acta Paleontologica Romaniae*, 2: 287–304.

Neagu, T. & Neagu, M., 1995. Smaller agglutinated foraminifera from the *acanthicum* Limestone (Upper Jurassic) Eastern Carpathians, Romania. In: Kaminski, M. *et al.*, (eds.), *Proceedings of the Fourth International Workshop on Agglutinated Foraminifera Grzybowski Foundation Special Publication*, 3: 211–225.

Nikishin, A. M., Cloetingh, S., Brunet, M. F., Stephenson, R. A., Bolotov, S. N. & Ershov, A. V., 1998. Scythian Platform, Caucasus and Black Sea region: Mesozoic–Cenozoic tectonic history and dymanics. In: Crasuin-Soleau, S. & Barrier, É (eds.), *Peri-Tethys Memoir 3: stratigraphy and evolution of Peri-Tethyan platforms. Mém. Mus. natn. Hist. nat.*, 177: 163–176, Paris

Oesterle, H., 1968. Foraminiferen der Typolokalität der Birmensdorfen-Schichten, unterer Malm (Teilrevision der Arbeiten von J. Kübler & H. Zwingli, 1866–1870 und von J. Haeusler, 1881–1893). *Eclogae geologae Helvetiae*, 61: 321–386.

Olszewska, B., 2005. Microfossils of the Cieszyn Beds (Silesian Unit, Polish Outer Carpathians) – a thin section study. *Polish Geological Institute Special Papers*, 19: 1–39

Oviechkin, H. K., 1956. Stratigraphy and ammonites from Upper Jurassic sediments of the southwestern Crimea (in Russian). *Vestnik Leningradskovo Universyteta*, 6: 12–29.

Pélissié, T., Peybernès, B. & Rey, J., 1982. Tectonique des plaques et paléobiogéographie des grands Foraminifères benthiques et des Algues calcaires du Dogger à l'Albien sur le pourtpour de la Mésogée. *Bulletin de la Société Géologique de France*, 24: 1069–1076.

Pélissié, T., Peybernès, B. & Rey, J., 1984. Les grands Foraminifères benthiques du Jurassique moyen/supérieur du sud-ouest de la France (Aquitaine, Causses, Pyrénées). Intérêt biostratigraphique, paléoécologique et paléobiogéographique. *Benthos 83, 2nd International Symposium on Benthic Foraminifera (Pau, April, 1983) Elf Aquitaine. Esso REP and Total CFP, Pau and Bordeaux*, 1984: 479–486.

Peybernès, B., 1976. Le Jurassique et le Crétacé inférieur des Pyrénées franco-espagnoles entre la Garonne et la Méditerranée. *These Sciences Naturelles Imp. C.R.D.P. Toulouse*, 459 pp.

Ramalho, M. M., 1971. Contribution à l'étude micropaléontologique et stratigraphique du Jurassique superiéur et du Crétacé inférieur des environs de Lisbonne (Portugal). *Serviços Geologicos de Portugal*, *Memoria* 19 (Nova Serie), 218 pp.

Redmond, C. D., 1964. Lituolid foraminifera from the Jurassic and Cretaceous of Saudi Arabia. *Micropaleontology*, 10: 405–414.

Řehánek, J. & Cecca, F., 1993. Calcareous dinoflagellate cysts biostratiography in the Upper Kimmeridgian–Lower Ttithonian pelagic limestones of Marches, Apennines (Central Italy). *Revue de Micropaléontologie*, 36: 143–163.

Romanov, L. F. & Danitch, M. M., 1971. *Moliuski i foraminifiery mezozoia dniestro-prutskogo mezhdurechia*. (In Russian). Akademia Nauk Moldavskoy SSR. 160 pp.

Sartoni, S. & Crescenti, U., 1962. Ricerche biostratigrafiche nel Mesozoico dell' Appennino Meridionale. *Giornale di Geologia*, 29: 161–252.

Said, R. & Bakarat, M. G., 1958. Jurassic microfossils from Gebel Maghara, Sinai, Egypt. *Micropaleontology*, 4: 231–272.

Schlagintweit, F. & Ebli, O., 1999. New Results on Microfacies, Biostratigraphy ans Sedimentology of late Jurassic–Early

Cretaceous platform carbonates of the Northern Calcareous Alps. *Abhandlungen der Geologischen Bundesanstalt*, 56: 379–418.

Schlagintweit, F., 1991. On the occurrence of *Amijella amiji* (Foraminifera) in the Tithonian/Berriasian of the Lerchkogel Limestone (Northern Calcareous Alps/Austria). *Revue de Paléobiologie*, 10: 247–253.

Schroeder, R., Guellal, S. & Vila, J. M., 1975. *Parurgonina caelinensis* Cuvillier, Foury & Pignatti Morano 1968 dans le Malm du Djebel Téioualt Constantinois, Algérie. *Eclogae geologae Helvetiae*, 68: 319–326.

Seibold, E. & Seibold, I., 1960. Foraminiferen der Bank-und Schwamm-Fazies im unteren Malm Süddeutschlands. *Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen*, 109: 309–438.

Septfontaine, M., 1988. Vers une classification evolutive des Lituolides (Foraminiferes) jurassiques en milieu de plateforme carbonatée. *Revue de Paléobiologie, Volume Spéciale*, 2, Benthos, 86: 229–256.

Sliter, W. V.,1989. Biostratigraphic zonation for Cretaceous planktonic foraminifers examined in thin section. *Journal of Foraminiferal Research*, 19: 1–19.

Sliter, W. V., 1999. Cretaceous planktic foraminiferal biostratigraphy of the Calera Limestone, northern California, USA. *Journal of Foraminiferal Research*, 29: 318–339.

Vašíček, Z., Michalík, J. & Reháková, D., 1994. Early Cretaceous stratigraphy, paleogeography and life in Western Carpathians. *Beringeria*, 10: 3–96.

Vogler, J., 1941. Ober-Jura und Kreide von Misol (Niederländisch-Ostindien) In: Beiträge zur Geologie von Niederländisch-Indien (ed. J. Wanner). *Palaeontographica, Suppl.* 4: 246–292.

Voloshina, A. M., Prosniakova, L. V. & Orlova-Turchina, G. A., 1965. New data on the age of the Lower Cretaceous rocks of the Tarkhancute Cape (The Crimea). (In Russian, English summary). *Paleontologicheskiy Sbornik*, 2: 104–107.

Voloshina, A. M., 1977. Mikrofauna and stage division of the Upper Jurassic and Lower Cretaceous deposits within two boreholes in the East Crimea. (In Ukrainian). *Dopovidi Akademii Nauk Ukrainskoy RSR*, 3: 195–198.

Wanner, J., 1940. Gesteinsbildende Foramioniferen aus malm und Unterkreide des östlichen Ostindischen Archipels nebst Bemerkungen über Orbulinaria Rhumbler und andere verwandte Foraminiferen. *Paläontologische Zeitschrift*, 22: 75–97.

Wernli, R. & Fookes, E., 1992. *Troglotella incrustans* n.gen., n.sp., un étrange et nouveau foraminifère calcicavicole du complexe récifal kimméridgien de Saint-Germain-de-Joux (Ain, France). *Bolletino della Società Paleontologica Italiana*, 31: 95–103.

Weynschenk, R., 1951. Two new Foraminifera from the Dogger and Upper Triassic of the Sonnwend Mountains of the Tyrol. *Journal of Paleontology*, 25: 793–795.

Winter, B., 1970. Foraminiferenfaunen des Unter-Kimmeridge (Mittlerer Malm) in Franken. *Erlanger Geologische Abhandlungen*, 79: 1–50.

Yudin, V. V., 1999. About position of Upper Jurassic massives of Crimea Mountain. (In Russian). *Reports of National Academy of Sciences of Ukraine*, 2: 139–144.

Yudin, V. V., 2001. *The geological structure of Crimea on the basis of actualistic geodynamics*. (In Russian). Committee on science and regional development of Crimean Academy of Science, Symferopol 46 pp.

Zaninetti, L., Salvini-Bonnard, G. & Decrouez, D., 1987. Montsalevia, n.gen. (Montsaleviidae, n. fam., Foraminifère), dans le Crétacé inférieur (Berriasien moyen-Valanginien) du Mont Saleve et du Jura Meridional (Haute savoie, France): Note préliminaire. *Revue de Paléobiologie*, 6: 165–168.

Zhabina, N. M., 1998. Correlation criterion Upper Yurassic deposits from the est and South petroleum begging regions of Ukraine. (In Ukraimian). *Paleontologichnyi Sbirnik*, 32: 77–82.

Zonenshain, L. P. & Le Pichon, X., 1986. Deep basins of the Black Sea and Caspian Sea as remants of Mesozoic back-arc basin. In: J. Auboin, X. Le Pichon & A.S. Monin (Eds), Evolution of the Tethys. *Tectonophysics*, 123: 181–211.