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BIOSTRATIGRAPHY OF PALEOGENE THE SOUTHERN UKRAINE BY SMALL BENTHIC FORAMINIFERA: RETROSPECTIVE VIEW

The article deals with history of small benthic foraminifera biostratigraphy of Paleogene deposits the southern Ukraine. The significance of O.K. Kaptarenko-Chernousova, A.M. Voloshina, M.V. Yartseva, Ye.Ya. Kraeva, A.P. Pechenkina, N.G. Savenko and I.D. Konenkova's works on study foraminifera is shown. Due to their investigarions the sequence and space-time relationships of Paleogene small benthic foraminifera assemblages have been determined in the southern Ukraine. Comparison foraminifera assemblages of Paleogene the southern Ukraine with intergerional benthic foraminifera zones of the Crimea-Caucasus Region is given. The article provides full references to previous literature on Paleogene foraminiferal biostratigraphy of the northern Peri-Black Sea Region and the southern slope of Ukrainian Shield. Up to the beginning the seventies years of the last century the researchers had distinguished and had described foraminifera assemblages characterizing Series and regional units of Paleogene the southern Ukraine. Taxonomic composition of benthic foraminifera assemblages was defined. Their spreading in Paleogene section of the northern Peri-Black Sea Region, the southern slope of Ukrainian Shield and adjacent part the Azov Crystalline Massif was studied. For some foraminifera assemblages the regional significance has been proved. Other assemblages are important for characterizing and dating suites, members, stratum and beds of the local stratigraphic schemes. Foraminifera associations of relatively deep-water depositional environments of the south of the northern Peri-Black Sea Region include species of zonal assemblages of interregional benthic foraminifers zones the Crimea-Caucasus Region. The most of distinguished benthic foraminifera assemblages are characteristic for shallow- and marginal-marine sediments of Paleogene basin in the northern Peri-Black Sea Region and its peripheral facies within depressions the southern slope of Ukrainian Shield. The space-time relations of benthic foraminifera assemblages are defined for Paleogene regional stages of the southern Ukraine section.
Key words: benthic foraminifera, Paleogene, biostratigraphy, southern Ukraine.

Introduction. Biostratigraphic units of foraminifera, namely zones and beds with fauna according to Stratigraphic Code of Ukraine [12, 92] and of the former Soviet Union [116], are among subdivisions grounded the Regional Stratigraphic Scheme of Paleogene deposits the southern Ukraine. Characteristic assemblages of zones and beds with foraminifera of the Scheme [64, 90, 91] include small benthic foraminifera (BF). Biostratigraphic units of small BF presented in the modern Regional Stratigraphic Scheme of Paleogene the southern Ukraine are compared to zonal associations of planktic and large foraminifera, calcareous nannofossils and dinoflagellate cysts.

Most of stratigraphically important small BF assemblages of the Paleogene the south Ukraine had been distinguished by O.K. Kaptarenko-Chernousova, M.V. Yartseva, A.M. Voloshina, Ye.Ya. Kraeva, A.P. Pechenkina, N.G. Savenko and I.D. Konenkova in the 50-60s years of XX century. Due to the further investigations of mentioned researchers and others the temporal and spatial distribution of these assemblages in Paleogene sediments of the northern Peri-Black Sea Region and adjacent areas of the Ukrainian Shield has been studied. For some of them regional significance has been proved, others have remained as local biostratigraphic subdivisions important for dating and characterizing suites (formations), members, stratum and beds. At the same time the current state of development zonal foraminiferal biostratigraphy of Paleogene deposits the southern regions of former Soviet Union (the Crimea-Caucasus Region) (CCR here, and in later text) [9, 39] allows more precise determination the stratigraphic position of small BF assemblages in Paleogene section the southern Ukraine.

The article deals with history of small BF biostratigraphy of Paleogene deposits the southern Ukraine, i.e. the northern Peri-Black Sea Region (NPBSR here, and in later text) and adjacent parts of the Ukrainian Shield (US here, and in later text) and Azov Crystalline Massif (ACM here,

and in later text). The main aim of the article is to show significance of foraminifera study by O.K.Kaptarenko-Chernousova, M.V. Yartseva, Ye.Ya. Kraeva, A.P. Pechenkina, A.M. Voloshina, N.G. Savenko, I.D. Konenkova for Paleogene biostratigraphy the southern Ukraine.

Notes on modern state of Paleogene stratigraphy of the southern Ukraine. The Ukraine sedimentary cover is divided into regional units. By the National Stratigraphic Code of Ukraine [12, 92] the main stratigraphic unit is a Regional Stage (Regiostage; syn.: Regional Horizon, Stratohorizon) regarding as reflection of stages of sedimentary basin' geological history, i. e. its peculiarities sedimentation, transgressive-regressive cycles, (sequence) evolution of fauna or/and flora and others.

The Stratigraphic Scheme of Paleogene the southern Ukraine includes the general, regional and local parts [64, 90, 91]. The first, general, part includes Series, Subseries and Stages of Paleogene International Stratigraphic Scale (ISS here, and in figures). The second part, Regional Scale, presents stratigraphic sequence of Regional Stages of Paleogene the southern Ukraine. The third, local, part of the Scheme reflects stratigraphic sequence and correlation of suites, members, stratum and beds of the structural-facial districts of the southern Ukraine.

Regional Stages of the Paleogene of southern Ukraine have rather interesting and long history of distinguishing, definition and ratification by Commission on Paleogene Stratigraphy of Interdepartmental Stratigraphic Committee of the former Soviet Union and by Regional Interdepartmental Stratigraphic Committee of Ukraine up to the end of XX century. Brief description of Paleogene Regiostages the southern Ukraine and special literature on that question are in the article [115]. All Paleogene Regiostages of the Southern Ukraine are identified as valid (real) stratigraphic units according to Stratigraphic Code of Ukraine [12, 92]. They have been accepted in following official stratigraphic schemes of Ukraine: "Regional Stratigraphic Schemes of Paleogene Deposits the South Ukraine Oil and Gas Area" [91], "Stratigraphic Scheme (Unified) of the Ukraine Paleogene Deposits" [64], "Stratigraphic Scheme of Paleogene Deposits of the Southern Regions of Ukraine" [90].

Succession of regional stages in official Regional Stratigraphic Scale (Regional SS here, and in figures) of the Paleogene of southern Ukraine (including the Crimea) is as follows: Paleocene – the Belokamenskian (Danian – lower part of Selandian) and Kachian (Selandian – Thanetian); Eocene – the Bakhchisaraian (lower Ypresian), Simferopolian (upper Ypresian – lower Lutetian), Novopavlovkian (Lutetian), Kumian (Bartonian), Almian (Priabonian); Oligocene – the Planorbellian (lower Rupelian), Molochnian (middle Rupelian) and Kerleutian (upper Rupelian – Chattian). Paleogene regiostages of the southern Ukraine, except the Molochnian, are defined or characterized by regional or provincial biozones of planktic and benthic foraminifera (table).

Biostratigraphic Scheme of Paleogene the southern Ukraine includes three kinds of biostratigraphic units of foraminifera, namely lone (= provincial biozone), biozone (assemblage-zone) and beds with foraminifera.

Most of suites, members, stratum and beds of Local Stratigraphic Schemes of Paleogene of the southern Ukraine [64, 67, 90, 91] are characterized by BF biozones, mainly assemblage-zones, and beds with foraminifera. Biostratigraphic zone (biozone) is a rock association contained the zonal assemblage of fossils (foraminifera). But according to the Stratigraphic Code of Ukraine [12] in the cases of undivided on zones deposists or in one gelogical section an auxiliary biostratigraphic unit the beds with fauna (or flora) are distinguished.

Materials and methods, research area. All published works on small BF including data on their distribution in sections, description of associations, intra- and interregional correlation based on foraminifera study, and also on corresponding beds with small BF to other associations of fossils, especially planktic and large foraminifera, calcareous nannofossils, organic-walled microphytoplankton have been analyzed. Presented in the article biostratigraphic generalization of the half past of XX century is based mainly on scientific elaborations of Ye.Ya. Kraeva [41-62 et al.], M.V. Yartseva [104-108 et al.], A.M. Voloshina [4, 10, 102, 103], A.P. Pechenkina [40, 59, 72, 73], I.D. Konenkova [21-37 et al.], N.G. Savenko [70, 82-84,101]. Also some works of O.K. Kaptarenko-Chernousova [16-19], E.K. Schutzkaya [89] and others [6, 63, 74-78] have been

Table

Small benthic foraminifera in characteristic assemblages of fossils of the Paleogene regional stages of the southern Ukraine

GSS			Regional Stratigraphic Scheme of Paleogene the Southern Ukraine		
System	Series	Stage	Regional Stage	Biostratigraphic units: lones (provincial zones), regional zones [64, 91]	
				Lona, Zona of foraminifera	Small benthic foraminifera in characteristic assemblages of fossils [64, 90, 91]
Paleogene	Oligocene	Chattian	Kerleutian	Porosononion dendridicus, Elphidium onerosum	*Porosononion dendridicus* (Chal.), *Cribrononion onerosum* Bogd., *Cibicidoides ornatus* (Bogd.), *Nonion granosus* Orb., *Quinqueloculina* aff. *selenae* (Karr.), *Spiroplectammina caucasica* Djan., *Bolivina* aff. *goudkoffi* (Rank.)
				Sphaeroidina variabilis	*Sphaeroidina variabilis* Reuss, *Haplophragmoides kerleuticus* Kosir (msc.), *Spiroplectammina terekensis* Bogr., *Uvigerinella californica* Cushm., *Cibicidoides nefastus* (J.Nik.)
		Rupelian	Molochnian		
			Planorbellian	Spiroplectammina oligocenica	*Spiroplectammina oligocenica* (J.Nik.), *Cyclammina contrictimargo* Srew. et Stew., *Neogyroidina memoranda* Subb., *Caucasina schischkinskyae* (Saml.), *Uvigerinella majcopica* Kraeva
				Lenticulina herrmani	*Lenticulina herrmani* (Andr.), *Heterolepa almaena* (Saml.), *Cibicidoides extremus* Schutz., *Bolivina mississippiensis* Cushm., *Gaudryinopsis gracilis* Cushm. et Laim.
	Eocene	Priabonian	Almian	Bolivina antegressa and large globigerinids	*Bolivina antegressa* Subb., *Marsonella indentata* (Cushm. et Jarv.), *Vulvulina spinosa* Cushm., *Marginulina behmi* (Reuss), *Marginulinopsis infracompressus* (Thalm.), *Robulus kubinyii* (Hantk.), *Uvigerina jacksonensis* Cushm., *Cibicidoides kasinaensis* (Schutz.), *C.jankulaensis* (Schuts.), *Rectuvigerina lacera* (Subb.)
		Bartonian	Kumian	Subbotina turcmenica, Subbotina instabilis	*Baggina valvulineriaformis* (N.Byk.), *Brotzenella acuta taurica* (Saml.), *Heterolepa pygmeuformis* Kraeva, *Caucasina eocaenica* Chal. (for the northern Peri-Black Sea Region)
		Lutetian	Novopavlovkian	Globigerinatheka subconglobata, Hantkenina alabamensis	*Spiroplectammina carinatiformis* Mor., *Falsoplanulina ammophila* (Guemb.), *Heterolepa eocaena* (Guemb.), *Uvigerina costellata* Mor., *Paragaudryina dalmatina* (Lieb.)
				Acarinina rotundimarginata	*Pseudogaudryina pseudonavarroana* (Bal.), *Clavulinoides golubjatnikovi* (Schutz.), *Hydromylinella iljini* (N.Byk.), *Heterolepa eocaena* (Gumb.)
		Ypresian	Simpheropolian	Acarinina bullbrooki	*Vaginulinopsis eofragaria* Bal., *Falsoplanulina ammophyla* (Gumb.), *Pseudogaudryina pseudonavarroana* (Bal.) (for the northern Peri-Black Sea Region)
				Morozovella aragonensis s.l.	
			Bakhchisaraian	Morozovella subbotinae s.l.	*Pseudogaudryina externa* Bugr., *Vaginulinopsis eofragaria* Bal., *Cibicidoides beatus* (Martin) (for the northern Peri-Black Sea Region)
	Paleocene	Thanetian	Kachian	Acarinina acarinata	
				Acarinina subsphaerica	*Anomalina fera* Schutz.
				Igorina djanensis	
		Selandian	Belokamenskian	Morozovella angulata	*Gaudryina gigantica* Subb., *Anomalina danica* Brotz., *Falsoplanulina ekblomi* (Brotz.), *Cibicidina bundensis* (van Bell.)
		Danian		Praemurica inconstans Globoconusa daubjergensis	*Arenobulimina dubia* Wolosch., *Cibicidoides burlingtonensis* (Jenn.), *Anomalina danica* Brotz., *Stensioina caucasica* (Subb.)

taken into account. Author's materials on foraminifera from outcrops and boreholes sections of central and eastern part of the NPBSR, the southern part of the US and the western ACM Region are also taken into account. The article is accompanied by a complit list of references on Paleogene foraminiferal biostratigraphy the studying region.

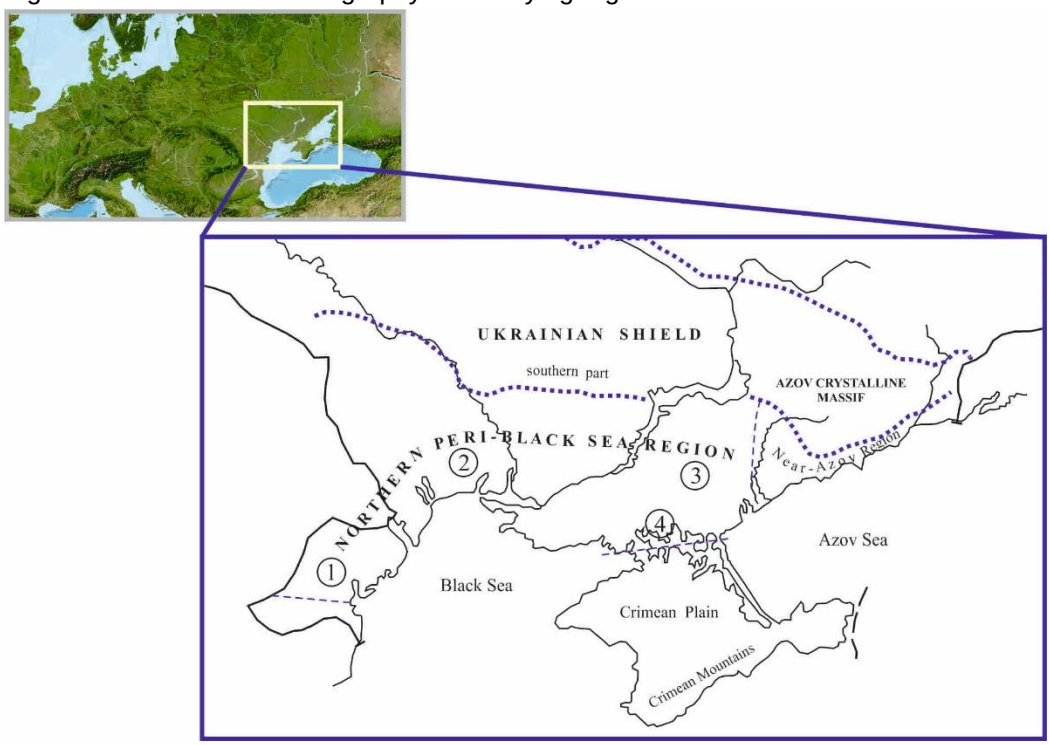

Fig.1. Research area of the southern Ukraine

The Peri-Black Sea Region: 1 - the south-western part; 2 - the western (central) part; 3 – the eastern part; 4 - the Near Sivach

Presented in the article author's bistratigraphic interpretation of BF assemblages of the southern Ukraine is based on modern foraminiferal zonation of the Paleogene of the south Russia, Crimean Peninsula, Central Asia and the Kazakhstan [9, 38, 39]. Yu.P. Nikitina's study of BF distribution in Paleogene of the south-east the Russian Platform and Skythian Plate [66] is also taken into account. The investigations are based on actualizes Regional Stratigraphic Scale of the southern Ukraine worked out by author in common with B.F. Zernetskiy and S.A. Lulyeva† [115].

In the describing part of article the term the beds with foraminifera is used in informal significance.

Because of the need to revise the systematic composition of Paleogene foraminifera the southern Ukraine, the table on small BF distribution is not given in the article. For the same reason, the names of foraminifera species are given in the wording of the authors of publications.

In the article BF associations are described from Paleogene deposits of the northern slope of Peri-Black Sea Depression more known in literature on stratigraphy as the NPBSR (Northern Prichernomorye), the southern slope of the US, the western, eastern and southern slopes of the ACM (Priazovie) (fig. 1). BF assemblages from Paleogene deposits of the Crimean Plain and foothills of the Crimean Mountains are not considered in the article.

Brief history of foraminifera studying of Paleogene the southern Ukraine. Due to investigations of O.K. Kaptarenko-Chernousova, M.V. Yartseva, Ye.Ya. Kraeva, A.M. Voloshina,

A.P. Pechenkina, N.G. Savenko and I.D. Konenkova the taxonomic composition of small foraminifera of Paleogene deposits the NPBSR and adjacent area of the US had been identified by the end of the seventies of the last century. Researchers have determined foraminifera associations of Paleocene, Eocene and Oligocene Subseries and those of regional stages (regional horizons) and have distinguished characteristic species and biostratigraphic units by small foraminifera for different regions.

Study of small foraminifera for stratification of Paleogene sections in the NPBS and manganese-ore deposits of the US was started by O.K. Kaptarenko-Chernousova and M.V. Yartseva in the fortieth of the last century.

In her works “Stratigraphy of Paleogene deposits of the Peri-Black Sea Depression (by foraminifera fauna)” [17], “About Lower Oligocene horizon with arenaceous foraminifera of the Peri-Black Sea Depression” [19] O.K. Kaptarenko-Chernousova (foto 1) mentioned BF “horizon with arenaceous foraminifera” and “horizon with *Spiroplectammina*” for the region.

The most known and non-losing stratigraphic significance M.V. Yartseva’s publications (foto 2) are “About Upper Eocene Miliolida of the Nikopol area and their habitat” [105], “To stratigraphy of Oligocene deposits of the south-eastern slope of Ukrainian Crystalline Shield (by foraminifera fauna)” [107], “Paleogene deposits of the southern slope of Ukrainian Crystalline Massif” [71]. She distinguished and determined stratigraphic position of some BF assemblages presenting in Local Stratigraphic Scheme of the south of US, namely “beds with miliolids, polymorphinids, *Epistomaria rimosa*”, “beds with *Nummulites variolarius*, *Cibicides carinatus*, *Rotalia armata*”, “beds with large lagenids, buliminids and *Clavulina*”, “beds with *Caucasina schischinskyae*, *Spiroplectammina oligocenica*”.

Foto 1. O.K. Kaptarenko-Chernousova


Foto 2. M.V. Yartseva

It should be mentioning A.M. Voloshina’s works of the sixtieth of the last century on foraminifera assemblages of Danian and Paleocene sediments of the Crimean Plain and adjacent part of the NPBSR [4, 102, 103]. She also distinguished deposits of Paleocene, Lower, Middle and Upper Eocene, Oligocene based on foraminifera in the south of NPBSR [10].

A.P. Pechenkina was the first who described in detail small foraminifera distribution on Paleogene section of the Odessa area (the south-western part of NPBSR) [40]. She distinguished foraminifera assemblages for Paleogene Series and Subseries according to point on view on Paleogene stratigraphy of that time. She noted that Paleocene foraminifera association includes species *Bolivinopsis spectabilis* (Grzyb.), *Anomalina danica* (Brotz.), *A. praeacuta* Vass., *Eponides lunatus* Brotz., *Siphonina prima* Plum., *Gyroidina globosa* (Hag.), *Angulogerina wilcoxensis* (Cushm. et Pont.) be known from Paleocene deposits of the Dnieper-Donets Depression, Crimean Peninsula and Caucasus. Lower-Middle Eocene deposits are characterized by two foraminifera complexes. The first one with numerous nummulitids, orbitoides, *Pulvinulinella granulosa* Moroz. (msc)., *Asterigerina norvaugi* Brotz., she considered be

analogous Lower Eocene "beds with *Pulvinulina granulosa* Moroz." of the West Crimea (today: Ypresian clays with *Morozovella subbotinae* (Moroz.)). The second association with *Heterostomella dalmatina* (Liebus), *H. pseudonavarroana* Balakhm., *Clavulina golubjatkikovi* Schutzk., *Cl.* aff. *szaboi* Hantk., *Uvigerinella kiewensis* Kapt. (msc.), *Tritaxilina identata* (Cushm. et Jarv.) A.P. Pechenkina regarded be analogous the lower part of "zone Globorotalia crassaeformis" of the North Caucasus and Crimean Peninsula.

From the Upper Eocene section of the Odessa area A.P. Pechenkina described the following succession of four foraminifera associations (from older to younger):

- association with dominating *Globorotalia*, presence of typical *Clavulina szaboi* Hantk., appearance of *Hantkenina alabamensis* Cushm., which she compared with upper part of "zone Globorotalia crassaeformis" of the Crimea and Northern Caucasus;
- association with numerous *Globorotalia crassaeformis* (Gall. et Wiss.), *G-lia penracamerata* Subb. and Globireginidae;
- association with small-size planktic foraminifera correlating with the same zone of planktic foraminifera of the Northern Caucasus and with "zone of small Bolivina and Bifarina millepuctata" of the Crimean Peninsula;
- association with rare *Cristellaria cultrata* (Montf.), *Bolivina reticulata* Hantk., *B. pusilla* Schw., *Uvigerina asperula* Cz., *Uv. auberiana* Orb., *Uv. jacksonensis* Cushm., *Uv. cocoaensis* Cushm., transition form from *Bulimina truncana* Guemb. to *Bul. sculptilis* Cushm., *Anomalina praeacuta* J. Nik. et Moroz. *dampelae* J. Nik. in litt., *Cibicides pseudoungerianus* Cushm., which she considered similar the Northern Caucasus "zone of large Globigerina".

In Oligocene part of the Odessa section, according to point of view on Paleogene stratigraphy of that period, A.P. Pechenkina identified the following foraminifera assemblages (from older to younger):

- association with numerous nummulitids and dominating buliminids (*Bolivina, Uviger*ina) which she correlated with "zone Bolivina" of the Northern Caucasus;
- association with rare *Nummulites* and numerous Anomalinidae (*Anomalina affinis* (Hantk.), *An. alazanensis* Nutt., *An. grosserugosa* (Guemb.)) and Lagenidae, frequent *Haplophragmoides* aff. *deforme* Andr., *Heterostomella* sp., *Cristellaria cultrata* (Montf.), *Cr. cultrata* (Montf.) *arcuato-striata* (Hantk.), rare *Nonion umbilicatulum* (Montf.), *N. labradoricus* (Daws.), *N.* aff, *schaphum* (Fich. et Moll.), *Uvigerina pygmea* Orb., *Uv. tenuistriata* Nutt. (non Reuss), *Valvulineria iphigenia* Sam., *Eponides* ex gr. *umbonatus* (Reuss), *Pulvinulinella almaensis* Sam., *Cibicides pygmeus* (Hantk.), *C. ungerianus* Cushm., *C. ungerianus* (Orb.), *C. lobatulus* (Walk. et Jac.), *Rhabdammina eocaenica* Cushm. et Hanna, *Saccammina sphaerica* M.Sars., *Proteonina difflugiformis* (Brady);
- association with arenaceous foraminifera and rare calcareous forms;
- association with non-numerous calcareous BF.

It is necessary to note the A.P. Pechenkina's publications of foraminifera assemblages of transition Eocene-Oligocene and Lower Oligocene of the NPBSR in which she has described "zone of arenaceous foraminifera and Haplophragmoides deformabilis" and "zone Asterigerina lucida and Cibicides salensis" [72, 73].

The main contribution into working out Paleogene foraminifera biostratigraphy of the southern Ukraine belongs Ye.Ya. Kraeva (foto 3). In her work "Foraminifera of Upper Eocene and Oligocene deposits the northern side of the Peri-Black Sea Depression" [44] she proposed the first zonal division of Eocene-Oligocene sections for different parts of the region. In section of the Tokmak-Melitopol area (the eastern part of the NPBSR) she distinguished the following foraminifera associatons (from older to younger):

- Upper Eocene "Iagenids-globorotaliids zone" with numerous *Lenticulina romeri* (Reuss), *Marginulina fragaria* (Guemb.) and rare *Lenticulina laticostata* (Tutkow.), *L. pseudomamilligera* (Plum.), *L. arcuato-striata* (Hantk.), different *Dentalina* and *Nodosaria*, numerous *Globorotalia pentacamerata* Subb. (5-chamber *Acarinina*). Among characteristic species are *Hydromylina rutteni* Puyt., *Uvigerina proboscidea* Schwag., *Valvulineria texana* Howe et Wall., *V. palmarealensis* (Nutt.), *Asterigerina stelligera* Kraeva;

- Upper Eocene “lagenids-globigerinids zone” with less various and numerous but larger in size lagenids (*Lenticulina romeri* (Reuss), *Robulus inornatus* Orb., *Marginulina fragaria* (Guemb.)), Nodosariidae, disappearance *Globorotalia*, presence Globigerinidae (*Globigerinella micra* (Cole), *Globigerina bulloides* Orb.), appearance *Bolivina antegressa* Subb. *costifera* Kraeva, *Planulina costata* (Hantk.), *Pl.* aff. *venezuelana* Nutt., *Anomalina alazanensis* Nutt., *An. acutiformis* Moroz. (msc.);
- Upper Eocene “buliminids zone” with various Buliminidae; among characteristic species are *Marginulina infracompressa* Thalm., *Turrilina alsatica* Andr., *Bulimina sculptilis* Cushm., *B. aksuatica* Moroz., *Bolivina nobilis* Hantk., *Uvigerina jacksonensis* Cushm., *Uv. jacksonensis* Cushm var. *delicatula* Kraeva, *Uv. costellata* Moroz.;
- Lower Oligocene “zone with arenaceous foraminifera” with various primitive agglutinated forms *Rhabdammina cylindrica* Glaessn., *Proteonina fusiformis* Will., *Reophax scalaria* Grzyb., *Haplophragmoides kiewensis* Kapt., *Cyclammina cancellata* Brady, *Spiroplectammina carinata* (Orb.), etc.
- Lower Oligocene “zone Spiroplectammina carinata” with numerous specimens of index-species and *Caucasina schischkinskii* (Sam.), *Bolivina mississippiensis* Cushm., less numerous *Uvigerinella majkopica* Kraeva, *Cibicides oligocenicus* (Sam.), *C. pseudoungerianus* Cushm., etc.

For the section of the Odessa-Kherson area (the central part of NPBSR) Ye.Ya. Kraeva introduced the following succession of foraminifera assemblages (from older to younger):

- Upper Eocene “zones with Hantkenina alabamensis” (“globorotaliids zone”) with dominating planktic foraminifera; among characteristic benthic species are *Nodosaria bacillum* Defr., *N. bulbosa* Halk., *Robulus kultratus* Montf., *R. arcuato-striata* Hantk., *Planularia infans* Kraeva, *Hydromylina* ? *rutteni* Puyt., *Anomalina pseudoacuta* Moroz., *An. acuta* Plumm. *discoidea* Balakhm., *An. affinis* (Hantk.), *Cibicides ungerianus* (Orb.), *Asterigerina stelligera* Kraeva, *Valvulineria palmarealensis* (Nutt.), *Siphonina kaptarenkae* Kraeva, *Kolesnikovella elongata* (Halk.), *Angulogerina proprius* Kraeva,;
- Upper Eocene “zone with Globigerina apertura” (“globigerinids zone”) with dominating *Globigerina*, *Globigerinella*; among characteristic BF are *Planulina* aff. *venezuelana* Kraeva, *Siphonina praereticulata* Kraeva, *Valvulineria texana* Howe et Wall., *Bolivina antegressa* Subb. *costifera* Kraeva and also *Lenticulina limbosa* Reuss, *Nodosaria exilis* (Neugeb.), *Bolivina pusilla* Schwag., *B. arta* Mact., *B.* aff. *microlancetiformis* Subb., *Uvigerina jacksonensis* Cushm., *Uv. costellata* Moroz., *Uv. densecostata* Kapt. (msc.), *Baggina iphigenia* (Sam.);
- Upper Eocene “zone with Marginulina infracompressa” or “middle zone” characterizing by impoverished foraminifera association with *Marginulina infracompressa* Thalm., *Anomalina grosserugosa* (Guemb.), *Eponides jacksonensis* Nutt., *E. perlata* Andr., *Gyroidina soldanii* Orb., *Pullenia quinqueloba* Reuss, *Asterigerina bracteata* Cushm., *Uvigerina densecostata* Kapt. (msc.), *Turrilina alsatica* Andr., *Bolivina antegressa* Subb., *Cassidulina globosa* Hantk.;
- Upper Eocene “zone with Asterigerina and Nonion” distinguishing by very impoverished complex of small BF with numerous *Eponides stellatus* Kraeva, *Asterigerina ambiqua* Kraeva, *Nonion umbilicatulus* (Montf.), *Cibicides* aff. *oligocenicus* Sam., *C.* aff. *pseudoungerianus* Cushm., *Turrilina alsatica* Andr.;
- Lower Oligocene “complex with Spiroplectammina carinata” (see above);
- Middle Oligocene “zone with Sphaeroidina variabilis” with numerous *Spiroplectammina carinata* Orb. *follis* Kraeva, *Cibicides pseudoungerianus* Cushm., *C. oligocenicus* Sam., *Nonion umbilicatulus* (Montf.), *Uvigerinella majkopica* Kraeva, *Sphaeroidina variabilis* Reuss.

In the Razdelnaya area section (the south-western part of the NPBSR) Ye.Ya. Kraeva distinguished the following succession of foraminifera assemblages (from older to younger):

- Upper Eocene “zone with Hantkenina alabamensis and Globigerina apertura” or “globorotaliids-globigerinids zone” marking by appearance *Planulina costata* (Hantk.), *Bulimina sculptilis* Cushm., *Uvigerina hispida* Schwag.; among characteristic BF are *Planularia infans* Kraeva, *Hydromylina rutteni* Puyt., *Planulina* aff. *venezuelana* Nutt., *Siphonina kaptarenkae* Kraeva, *Uvigerina jacksonensis* Cushm., *Uv. hispida* Schwag., *Bolivina antegressa* Subb., *Angulogerina proprius* Kraeva and others;

- Upper Eocene “zone with Globigerinoides conglobatus” characterizing by *Marginulina infracompressa* Thalm., numerous index-species, *Bulimina sculptilis* Cushm., *Uvigerina densecostata* Kapt. (msc.), *Uv. costellata* Moroz., etc.;
- Upper Eocene “zone with Globigerina bulloides and arenaceous foraminifera” distinguishing by numerous agglutinated foraminifera *Reophax* ex gr. *nodulosus* Brady, *R. plana* Halk., *R. scalaria* Grzyb., *Proteonina fusiformis* Will., *Haplophragmoides eggeri* Cushm., *Clavulina szaboi* Hantk., *Heterostomella dalmatina* Liebus, impoverished association with calcareous forms *Frondicularia budensis* (Hantk.), *Robulus carinatus* Kraeva, *Uvigerina densecostata* Kapt. (msc.), *Cassidulina globosa* Hantk., *Bifarina millepunctata* Tutkow., *Lingulina* sp.

Ye.Ya. Kraeva also distinguished the Paleocene “anomalinids complex” [58], the Middle Eocene “beds with *Hopkinsina bykovae ukrainica*” [97], the Upper Oligocene “zone Sphaeroidina” and “nonionids complex” [41, 61] in the NPBSR.

I.D. Konenkova (foto 4) in her work “Foraminifera biostratigraphy of Danian and Paleocene deposits of the Northern Peri-Black Sea Region” [26] has proved by planktic and benthic foraminifera the presence of the Lower and Upper Paleocene deposits in the region. She has determined the following succession of shallow-water BF associations: “complex with *Cibicidoides commatus*”, “complex with *Anomalina burlingtonensis*” and “complex with *Cibicides bundensis* and *Nonion multisuturatum*” in Lower Paleocene deposits and “complex with anomalinids” and “complex with *Bolivinopsis spectabilis*” in Upper Paleocene. Also she described Lower Eocene foraminifera association in the south of NPBSR [27, 33]. Doubtless interests has her articles devoted to description foraminifera associations of the Priabonian of the southern part of US [36] and the NPBSR [22], transitional Eocene-Oligocene interval of the eastern part of the NPBSR [30] and the eastern part of Near-Azov Region [31].

Foto 3. Ye.Ya. Kraeva

Foto 4. I.D. Konenkova

Foto 5. N.G. Savenko

N.G. Savenko (foto 5) in her dissertation “Biostratigraphy of Upper Eocene deposits the Peri-Black Sea Depression by small foraminifera” [83] and other works [11, 100, 101] has proved presence of foraminifera assemblages of the Kuberla, Keresta, Kuma and Alma Stratohorizons of the CCR in the NPBSR. She also described in detail foraminifera associations of those horizons for different parts of the NPBSR. N.G. Savenko grounded presence of three biostratigraphic zones in Priabonian deposits of the NPBSR connecting with different facies, namely “zone Nonion, Asterigerina and Nummulites” characterizing shallow-water sediments in central part of the region, “zone Asterigerina lucida and Cibicides salensis” of more deep-water sediments of the north-western part of the region and “zone Globigerinoides conglobatus and Bolivina antegressa” of the most deep-water sediments of the north-eastern and southern parts of the NPBSR.

Present state of benthic foraminifera biostratigraphy of Paleogene deposits of the northern Peri-Black Sea Region, adjacent areas of the Ukrainian Shield and Azov Crystalline Massif. This part of article deals with retrospective view on distinguishing

associations of small BF in Paleogene deposits of the NPBSR and adjacent areas of the US and ACM, author's opinion on their stratigraphic position and correlation with interregional BF zones of the CCR [9, 38, 39].

Paleocene. Up to beginning the sixties years of the last century deposits of Paleocene age had been proved by foraminifera in narrow coastal zone along the northern Black Sea, Sivash Gulf and Azov Sea [10]. After A.M. Voloshina the Paleocene BF assemblage of the region includes *Ataxophragmium variabile* (Orb.)*, *Spiroplectammina variata* Vass.*, *Textularia* ex gr. *baudoniana* (Orb.), *Gaudryina retusa* Cushm.*, *Marsonella* aff. *oxycona* (Reuss)*, *Dorothia buletta* Carsey, *Arenobulimina mohreni* Brotz.*, *Ar. dubia* Wolosh.*, *Ataxophragmium depressaeformis* Ploth., *At. frankei* (Brotz.)*, *Eponides saginaris* N.Byk., *Anomalina danica* (Brotz.)*, *An. ekblomi* (Brotz.)*, *An.* aff. *praeacuta* Vass.*, *Valvulineria allomorphinoides* Reuss, *Gyroidina umbilicata* (Orb.), *Cibicides hemicompressus* Moroz.*, *C. incognitus* Vass.*, *C. lectus* Vass.*, *C. commatus* Moroz.*

Author's notes. According to modern biostratigraphic ideas [9, 39] this assemblage corresponds to Danian interregional zone Anomalina danica s. l. of the CCR (fig. 2). This conclusion is grounded on presence characterizing species of the zone marked by (*) in the list.

Due to further foraminifera study of A.M. Voloshina, I.D. Konenkova, Ye.Ya. Kraeva, E.K. Schutzkaya the Paleocene section of the NPBSR was subdivided into lower (now = Belokamenskian Regiostage) and upper (now = Kachian Regiostage) Subseries.

Belokamenskian Regional Stage. A.M. Voloshina [4, 102] has described shallow-water "danian-paleocene" BF assemblage in borehole of the south-western part of Near-Azov Region. She indicated *Arenobulimina mohreni* Brotz., *Ar. cuskleyae* Jenn.*, *Triloculina* aff. *inflata* Orb., *Quinqueloculina* aff. *inflata* Orb., *Guttulina ipatovcevi* Vass., *G.* aff. *austriaca* Orb., *G. lidiae* Vass., *Globulina amygdaloides* Reuss, *Gl. gibba* Orb., *Gl. rotundata* (Born.), *Anomalina danica* (Brotz.)*, *Cibicides simplex* Brotz.*, *C. reinholdi* ten Dam, *C. ekblomi* Brotz.*, *C. favorabilis* Vass., *Gyroidina octocamerata* Cushm. et Hanna, *Globorotalites lobata* Brotz.*, *Glob.* aff. *toulmini* (Brotz.)*, *Coleites crispus* Vass., *Elphidiella prima* (ten Dam)*, *Nonion* aff. *graniferum* (Terq.), *Buliminella parvula* Brotz.*, *Bolivina* aff. *ödumi* Brotz., *Allomorphina halli* Jenn.* et others.

Author's notes. This assemblag also corresponds to Danian interregional zone Anomalina danica s. l. of the CCR [9] (characterizing species are marked by (*) in the list).

Later I.D. Konenkova [26, 27] distinguished three BF assemblages in Lower Paleocene section of the NPBSR: "complex with *Cibicides commatus*", "complex with *Anomalina burlingtonensis*" and "complex with *Cibicides bundensis* and *Nonion multisuturatum*". She also described BF association of shallow-water peripheral facies of the Paleocene sea in Belokamenskian time.

Beds with *Cibicidoides commatus* were distinguished by I.D. Konenkova in boreholes 52 (Novokievka) and 72 (Novaya Mayachka) drilled in the Kherson area, the south of eastern part of the NPBSR. The BF association includes *Ataxophragmium frankei* Brotz., *Arenobulimina presli* Reuss, *Ar. dubia* Wolosch., *Anomalina danica* Brotz., *An. burlingtonensis* (Jenn.), *An. ekblomi* (Brotz.), *An. umbilicata* Mjatl., *Cibicides invisus* Vass., *C. commatus* Moroz., *C. spiropunctatus* Gall., *Coleites reticulosus* (Plumm.), *Gyroidina umbilicata* Orb., *Eponides frankei* Brotz., *Globorotalites perforatus* Vass., *Pulsiphonina elegans* Brotz. These layers coresponds to Danian planktic foraminifera zone Globoconusa daubjergensis [26, 27] and calcareous nannofossils zone NP 3 [5, 6], characterizing the Lower Belokamenskian Regional Substage of the southern Ukraine.

I.D. Konenkova [26, 28] has noted that BF assemblage of beds with *Cibicidoides burlingtonensis* in comparison with the same of beds with *Cibicidoides commatus* is some shallower and differs on appearance *Anomalina midwayensis* (Plumm.), *Cibicides sahlstromi* Brotz., *C. neumanae* Plumm., *Gyroidina octocamerata* (Cushm. et Hanna), *Mississippina binkhorsti* (Reuss), *Reussella paleocenica* (Brotz.), *Rosalina selandiana* Poz. et Szc., *Pararotalia globigeriniformis* (van Bell.). Researcher conditionally correlated these beds to planktic foraminifera Praemurica inconstans zone. Taking into account data on planktic foraminifera [4, 26, 102], beds with *Cibicidoides burlingtonensis* should be coresponded Danian lone Globoconusa daunbjergensis – Praemurica inconstans.

In the southern part of Molochna river basin (the south-western part of the Near-Azov Region) I.D. Konenkova [25, 34, 35, 37] described the most shallow-water BF association of the beds with *Cibicidoides burlingtonensis*, which is distinguished by predomination of *Anomalina danica* Brotz., *An. ekblomi* (Brotz.), *Cibicides burlingtonensis* Jenn., *C. neumanae* Plumm., *C. sahlstromi* (Brotz.), numerous *Nonion* ex gr. *graniferum* (Terq.), *Protelphidium* ex gr. *sublaeve* (ten Dam) and less numerous polymorphinids and miliolids.

Author's notes. BF assemblges of beds with *Cibicidoides commatus* and beds with *Cibicidoides burlingtonensis* contain characterizing species of the Lower Belokamenskian Regional Substage of the southern Ukraine, namely *Arenobulimina dubia* Wolosh., *Anomalina danica* Brotz., *Cibicidoides burlingtonensis* (Jenn.), *Pararotalia globigeriniformis* (van Bell.) (see table). Also taxonomic composition of BF of the beds is close to that of Danian interregional zone Anomalina danica s. l. of the CCR [9] and zone Cibicidoides lectus characterizing the Pselian Regional Stage of the Dnieper-Donets Depression [80]. This is proved by presence *Arenobulimina prestli* Reuss., *Ataxophragmium frankei* Brotz., *Anomalina danica* Brotz., *Gavelinella umbilicata* Brotz., *Cibicidoides commatus* (Moroz.), *Intricatus spiropunctatus* (Gall. et Morr.), *Gyroidinoides octocameratus* (Cushm. et Hanna), *Pulsiphonina elegans* Brotz., *Falsoplanulina ekblomi* (Brotz.), *Pararotalia globigeriniformis* (van Bell.), *Coleites reticulosus* (Plumm.), *Rosalina selandiana* Poz. et Szc., *Reusella paleocenica* (Brotz.), *Mississippina binkhorsti* (van Bell.) and others in BF assemblages of the beds. On my opinion the described BF associations of beds with *Cibicidoides commatus* and beds with *Cibicidoides burlingtonensis* should be defined as assemblage-zone Anomalina danica and Cibicidoides commatus characterizing lower part of the Belokamenskian Regiostage in the NPBSR (see fig. 2). Authorship of this zone is preservated after I.D. Konenkova.

BF association of beds with *Cibicidina bundensis* and *Nonion multisuturatum*, distinguished by I.D. Konenkova [23, 25, 26, 35, 37] in the south of the eastern and western parts of the NPBSR, reflects shallow-marine depositional environments of peripheral parts of Paleocene sea in late Belokamenskian time. Differing by numerous anomalinids, polymorphinids, rotaliids and miliolids, the complex includes *Anomalina danica* (Brotz.)*, *An. burlingtonensis* (Brotz.), *An. ekblomi* (Brotz.)*, *An. simplex* (Brotz.), *Cibicides sahlstromi* Brotz., *C. bundensis* van Bell.*, *C. succeedens* Brotz., *Nonion graniferum* (Terg.), *Nonion multisuturatum* van Bell., *Eponides toulmini* Brotz., *Globorotalites lobata* Brotz., *Rosalina koeneni* Brotz., *R. selandiana* Poz. et Szc., *Rotalia lithothamnica* Uhlig. *katchanensis* Schutzk., *Pararotalia globigeriniformis* (van Bell.), *P. macheili* Loebl. et Tapp., *P. scabrosa* Konen., *Proteelphidium sublaeve* (ten Dam.), *Elphidiella prima* (ten Dam.), *Lamarckina rugulosa* (Plumm.), *Reussella paleocenica* (Brotz.) and others. This assemblage contains characterizing species of the Upper Belokamenskian Regional Substage of the southern Ukraine (marked by (*) in the list). The beds also contain calcareous nannoplankton of zone NP 5 [5, 6], characterizing the same stratigraphic level.

Author's notes. Taking into account stratigraphic position of beds with *Cibicidina bundensis* and *Nonion multisuturatum* in the Lower Paleocene section of the south of NPBSR and data on calcareous nannofossils, these beds should be considered as the most shallow-water layers of the Upper Belokamenskian Regional Substage (see fig. 2) and probable stratigraphic analogue of Selandian interregional zone Pyramidina crassa of in the CCR [9].

Belokamenskian Regional Stage. A.M. Voloshina [4, 102] has described shallow-water "danian-paleocene" BF assemblage in borehole of the south-western part of Near-Azov Region. She indicated *Arenobulimina mohreni* Brotz., *Ar. cuskleyae* Jenn.*, *Triloculina* aff. *inflata* Orb., *Quinqueloculina* aff. *inflata* Orb., *Guttulina ipatovcevi* Vass., *G.* aff. *austriaca* Orb., *G. lidiae* Vass., *Globulina amygdaloides* Reuss, *Gl. gibba* Orb., *Gl. rotundata* (Born.), *Anomalina danica* (Brotz.)*, *Cibicides simplex* Brotz.*, *C. reinholdi* ten Dam, *C. ekblomi* Brotz.*, *C. favorabilis* Vass., *Gyroidina octocamerata* Cushm. et Hanna, *Globorotalites lobata* Brotz.*, *Glob.* aff. *toulmini* (Brotz.)*, *Coleites crispus* Vass., *Elphidiella prima* (ten Dam)*, *Nonion* aff. *graniferum* (Terq.), *Buliminella parvula* Brotz.*, *Bolivina* aff. *ödumi* Brotz., *Allomorphina halli* Jenn.* et others.

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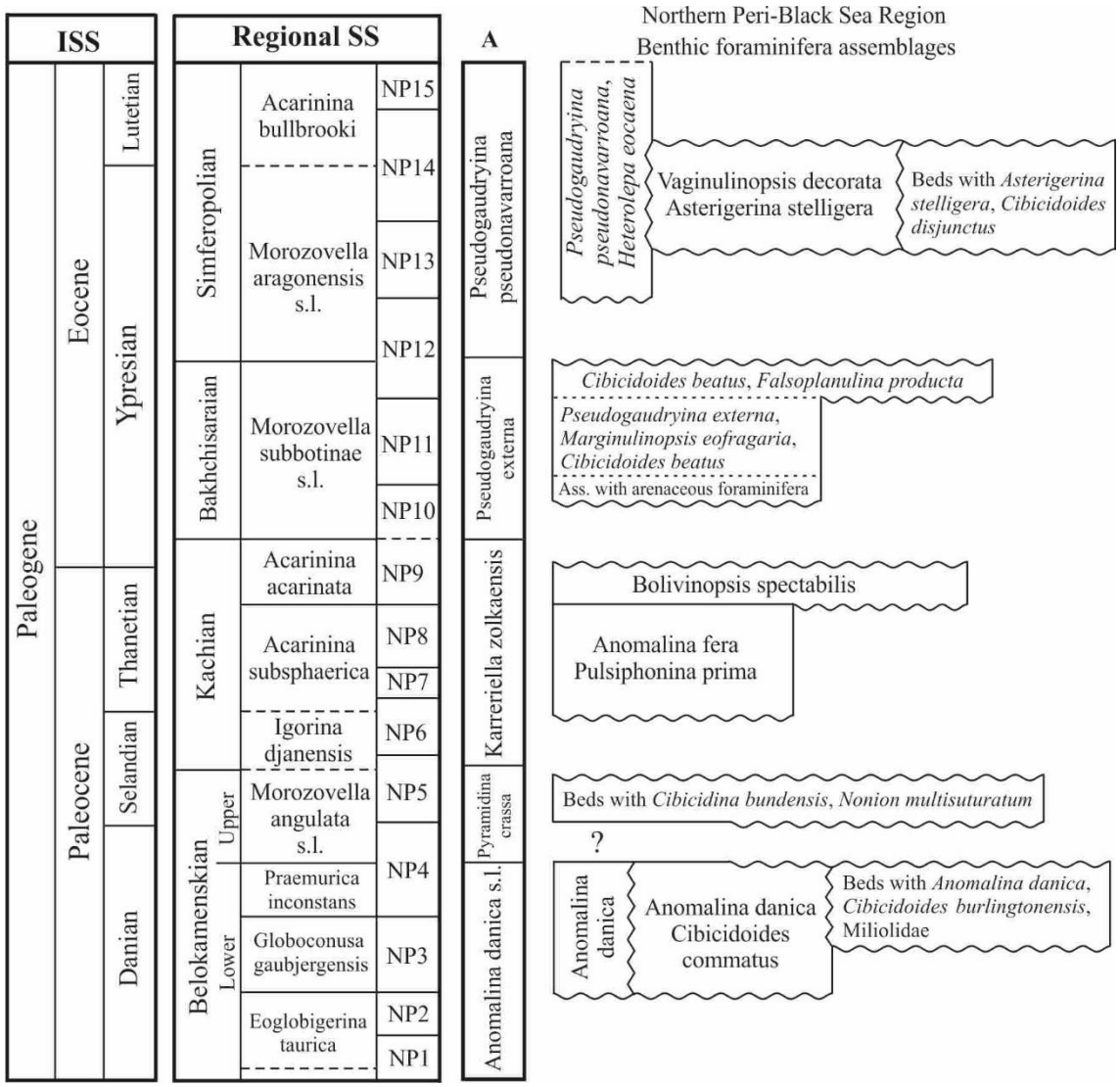

Fig. 2. Sequence of small benthic foraminifera assemblages in Paleocene – Lower Eocene the southern Ukraine

A - interregional benthic foraminifera zones of the Crimea-Caucasus Region [9, 39]

Later I.D. Konenkova [26, 27] distinguished three BF assemblages in Lower Paleocene section of the NPBSR: “complex with *Cibicides commatus*”, “complex with *Anomalina burlingtonensis*” and “complex with *Cibicides bundensis* and *Nonion multisuturatum*”. She also described BF association of shallow-water peripheral facies of the Paleocene sea in Belokamenskian time.

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Author's notes. BF assemblges of beds with *Cibicidoides commatus* and beds with *Cibicidoides burlingtonensis* contain characterizing species of the Lower Belokamenskian Regional Substage of the southern Ukraine, namely *Arenobulimina dubia* Wolosh., *Anomalina danica* Brotz., *Cibicidoides burlingtonensis* (Jenn.), *Pararotalia globigeriniformis* (van Bell.) (see table). Also taxonomic composition of BF of the beds is close to that of Danian interregional zone Anomalina danica s. l. of the CCR [9] and zone Cibicidoides lectus characterizing the Pselian Regional Stage of the Dnieper-Donets Depression [80]. This is proved by presence *Arenobulimina prestli* Reuss., *Ataxophragmium frankei* Brotz., *Anomalina danica* Brotz., *Gavelinella umbilicata* Brotz., *Cibicidoides commatus* (Moroz.), *Intricatus spiropunctatus* (Gall. et Morr.), *Gyroidinoides octocameratus* (Cushm. et Hanna), *Pulsiphonina elegans* Brotz., *Falsoplanulina ekblomi* (Brotz.), *Pararotalia globigeriniformis* (van Bell.), *Coleites reticulosus* (Plumm.), *Rosalina selandiana* Poz. et Szc., *Reusella paleocenica* (Brotz.), *Mississippina binkhorsti* (van Bell.) and others in BF assemblages of the beds. On my opinion the described BF associations of beds with *Cibicidoides commatus* and beds with *Cibicidoides burlingtonensis* should be defined as assemblage-zone Anomalina danica and Cibicidoides commatus characterizing lower part of the Belokamenskian Regiostage in the NPBSR (see fig. 2). Authorship of this zone is preservated after I.D. Konenkova.

BF association of beds with *Cibicidina bundensis* and *Nonion multisuturatum*, distinguished by I.D. Konenkova [23, 25, 26, 35, 37] in the south of the eastern and western parts of the NPBSR, reflects shallow-marine depositional environments of peripheral parts of Paleocene sea in late Belokamenskian time. Differing by numerous anomalinids, polymorphinids, rotaliids and miliolids, the complex includes *Anomalina danica* (Brotz.)*, *An. burlingtonensis* (Brotz.), *An. ekblomi* (Brotz.)*, *An. simplex* (Brotz.), *Cibicides sahlstromi* Brotz., *C. bundensis* van Bell.*, *C. succeedens* Brotz., *Nonion graniferum* (Terg.), *Nonion multisuturatum* van Bell., *Eponides toulmini* Brotz., *Globorotalites lobata* Brotz., *Rosalina koeneni* Brotz., *R. selandiana* Poz. et Szc., *Rotalia lithothamnica* Uhlig. *katchanensis* Schutzk., *Pararotalia globigeriniformis* (van Bell.), *P. macheili* Loebl. et Tapp., *P. scabrosa* Konen., *Proteelphidium sublaeve* (ten Dam.), *Elphidiella prima* (ten Dam.), *Lamarckina rugulosa* (Plumm.), *Reussella paleocenica* (Brotz.) and others. This assemblage contains characterizing species of the Upper Belokamenskian Regional Substage of the southern Ukraine (marked by (*) in the list). The beds also contain calcareous nannoplankton of zone NP 5 [5, 6], characterizing the same stratigraphic level.

Author's notes. Taking into account stratigraphic position of beds with *Cibicidina bundensis* and *Nonion multisuturatum* in the Lower Paleocene section of the south of NPBSR and data on calcareous nannofossils, these beds should be considered as the most shallow-water layers of the Upper Belokamenskian Regional Substage (see fig. 2) and probable stratigraphic analogue of Selandian interregional zone Pyramidina crassa of in the CCR [9].

Kachian Regional Stage. Up to the sixties years of the last century in the NPBSR the Paleocene deposits had been considered as undivided [10, 18, 40, 58]. Further Ye.Ya. Kraeva, I.D. Konenkova and A.M. Voloshina's investigations have proved Upper Paleocene by small foraminifera in the region. These researchers distinguished two separate foraminifera associations characterizing the section: the first known as "anomalinids complex" (beds with *Anomalina fera* and *Pulsiphonina prima* below in the text) and the second – "complex with arenaceous foraminifera" (beds with *Bolivinopsis spectabilis* below in the text).

Beds with *Anomalina fera* and *Pulsiphonina prima*. A.P. Pechenkina [40] was the first who determined Paleocene foraminifera assemblage with dominating anomalinids and *Siphonina* from borehole 1 (Mirnoe) drilled not far from Odessa (the southwestern part of the NPBSR). She noted that this assemblage is distinguished by numerous *Anomalina danica* (Brotz.), *An. acuta* Plumm., frequent *An. praeacuta* Vass., *Siphonina prima* Plumm., rare *An. grosserugosa* (Guemb.), *Eponides umbonatus* (Reuss), *Angulogerina wilcoxensis* (Cushm. et Pont.) and sporadic *Ammodiscus incertus* (Orb.), *Bolivinopsis spectabilis* Grzyb., *Nodosaria affinis* Orb., *Dentalina approximata* Reuss, *Eponides lunatus* Brotz., *Gyroidina globosa* (Hag.), *Pullenia quinqueloba* Reuss, *Asterigerina norvaugi* Brotz., *Cibicides favorabilis* Vass., *C.* aff. *incognitus* Vass., etc.

In boreholes drilled in the western part of the NPBSR Ye.Ya. Kraeva [58] described Paleocene "anomalinids complex" consisting of *Heterostomella gigantica* Subb., *Anomalina danica* Brotz., *Cibicides proprius* (Brotz.), *C. favorabilis* Vass., *Siphonina prima* Plumm., *Alabamina wilcoxensis* Toulm., etc.

For Upper Paleocene deposits of the Near-Sivash area A.M. Voloshina [103] indicated BF assemblage with numerous large arenaceous foraminifers *Lituoloba taylorensis paleocenica* Wolosh., *Paragaudryina gigantica* (Subb.) and secreted foraminifers *Cibicides hemicompressus* Moroz., *C. commataeformis* N. Byk. (msc.), *Karreria fallax* Reuss.

I.D. Konenkova [21, 24, 27, 28] gave detailed description the "anomalinids complex" and its distribution in Upper Paleocene of the NPBSR. According her this BF assemblage is distinguished by numerous anomalinids *Anomalina fera* Schutz., *An. danica* Brotz., *Cibicides proprius* Brotz., *C.* aff. *faraonis* Le Roy, *C. sahlstromi* Brotz., *C. hemicompressus* Moroz., *Gavelinella limbata* Olss., and also *Heterostomella gigantica* Subb., *Vaginulina robusta* Plumm., *Pulsiphonina prima* (Plumm.), *P. elegans* Brotz., *Parella convexa* Olss., *Globorotalites lobata* Brotz., *Pseudoparella minuta* Olss., *Stensioina caucasica* (Subb.), *Buliminella parvula* Brotz., *Bolivina selmensis* Cushm., *Spirobolivina scanica* (Brotz.). She described two foraminifera associations characterizing "anomalinids complex": the first with dominating *Pulsifonina* and numerous *Anomalina*, *Cibicides*; the second with dominating *Anomalina* and *Cibicides*, numerous *Pulsiphonina*, few agglutinated forms.

In the NPBSR the beds with "anomalinids complex" correspond to planktic foraminifera zone Acarinina subsphaerica [24, 26, 27] and calcareous nannofosslis of zonal interval NP 6–NP 8 [5, 6] characterizing the Kachian Regiostage.

Author's notes. These BF assemblages contain index-species *Anomalina fera* Schutz. of the Kachian Regiostage the southern Ukraine. I propose to rename the "anomalinids complex" as assemblage-zone Anomalina fera and Pulsiphonina prima and preservate authorship I.D. Konenkova. Small BF of zone Anomalina fera and Pulsiphonina prima, characterizing the Kachian of the NPBSR, are known from Paleocene deposits of the CCR [9, 66]. But such species as *Anomalina fera* Schutzk., *Asterigerina norvangi* Brotz., *Angulogerina wilcoxensis* Cushm. et Appl., *Sporobolivina scanica* (Brotz.) permit to define Thanetian zone Anomalina fera of the Bakhchisarai stratotype region in Crimean Peninsula [9]. Thus, according to modern biostratigraphic ideas [9, 39] zone Anomalina fera and Pulsiphonina prima of the NPBSR should be regarded as stratigraphic analogue of Thanetian interregional zone Karreriella zolkaensis of the CCR (see fig. 2).

Beds with *Bolivinopsis spectabilis*. From Upper Paleocene deposits in borehole 2-p Chaplinka (the Near-Sivash area) A.M. Voloshina [103] reported arenaceous foraminifera assemblage similar to that one in the Kerch Peninsula. It consists of *Rhabdammina maxima*

(Fridb.), *Rh. cylindrica* Glaessn., *Rhizammina indivisa* Brady, *Bathysiphon nodosariaformi*s Subb., *Nodellum velascoense* (Cushm.), *Trochamminoides coronatus* (Brady), *Tr. irregularis* White, *Haplophragmoides valteri* (Grzyb.), *Ammodiscus incertus* Cushm. et Jarv., *Glomospira charoides* (Park. et Jin.), *Bolivinopsis spectabilis* (Grzyb.), *Matanzia paleocenica* (Hofk.), others.

At the same time in the Upper Paleocene section of the NPBSR above the beds with "anomalinids complex" (zone Anomalina fera and Pulsiphonina prima here) I.D. Konenkova [21, 24, 27, 35] distinguished association with dominating but non numerous arenaceous foraminifera *Rhabdammina indivisa* Brady, *Rh. cylindrica* Glaessn., *Ammodiscus incertus* (Orb.), *Haplophragmoides kubanensis* Schutzk., *H. walteri* (Grzyb.), *H. tenuis* Cushm., *Glomospira charoides* (Park. et Jon.), *Bolivinopsis spectabilis* (Grzyb.), rare sporadic secreted foraminifera *Anomalina fera* Schutzk., *Cibicides proprius* Brotz., *Pulsiphonina prima* (Plumm.), *Pullenia quinqueloba* Reuss, *Spirobolivina scanica* Brotz., etc. She named this association as "complex with *Bolivinopsis spectabilis*" [26, 27].

In the NPBSR the described beds correspond to planktic foraminifera zone Acarinina acarinata [26, 27] and calcareous nannofossils zone NP 9 [5, 6], characterizing upper part of the Kachian Regiostage the southern Ukraine.

Author's notes. On my opinion BF association of the beds should be considered as assemblage-zone Bolivinopsis spectabiling characterizing the upper Kachian Regiostage in the NPBSR (see fig. 2). Authorship of this zone is preservated after I.D. Konenkova. Due to presence *Rhizammina indivisa* Brady, *Bathysiphon nodosariaformis* Subb., *Nodellum velascoense* (Cushm.), *Haplophragmoides kubanensis* Schutzk., *H. tenuis* Cushm., *H. walteri* (Grzyb.), *Repmanina charoides* (Park. et Jon.), *Trochamminoides irregularis* White, *Bolivinopsis spectabilis* (Grzyb.), *Bol. kurtishensis* Balakhm., *Marsonella indentata* (Cushm. et Jon.), *Anomalina fera* Schutzk., *Cibicidoides proprius* (Brotz.), *Pulsiphonina prima* (Plumm.), *Stensioina caucasica* (Subb.), *Reussella paleocenica* Brotz., *Sporobolivina scanica* Brotz., the zone Bolivinopsis spectabilis of the NPBSR is regarded as stratigraphic shallow-water analogue of Thanetian interregional zone Karreriella zolkaensis of the CCR [9].

Eocene. A.M. Voloshina, A.P. Pechenkina, Ye.Ya. Kraeva, N.G. Savenko and I.D. Konenkova's investigations had proved the Lower, Middle and Upper Eocene by small foraminifera up to the middle seventies of the last century in the NPBSR. M.V. Yartseva had done the Middle and Upper Eocene by BF in depressions of the southern slope the US up to the sixties years of the last century. The most rich, various and numerous BF assemblages characterize the Middle (Novopavlovkian Regiostage) and Upper (Almian Regiostage) Eocene deposits of the region. In the NPBSR the deposits of upper part of Kumian Regiostage contain, in the main, radiolarians, spongue spicules and rare, sporadic BF shells *Baggina iphigenia* (Sam.), *Planulina* aff. *venezuelana* Nutt., *Spiroplectammina vicina* Erem. and small arenaceous foraminifers [64]. This association do not considers in the article.

Bakhchisaraian Regional Stage. In the south of NPBSR three BF assemblages are known from the Lower Ypresian.

From borehole Chaplinka (the Near-Sivash area) A.M. Voloshina [10] described association consisting of predominately arenaceous foraminifera *Rhabdammina indivisa* Brady, *Proteonina complanata* (Fr.), *Reophax duplex* Grzyb., *Ammodiscus glabratus* Cushm., *Spiroplectammina clotho* Grzyb., *Sp. rosula* Her., *Sp.* aff. *dentata* (Alth.), *Frankeina* aff. *taylorensis* Cushm. et Wall., *Textularia agglutinans* Orb., *Trochammina advena* Cushm., *Gaudryina rugosa* Orb., *Heterostomella gigantica* Subb., *Clavulina angularis* Orb., *Karreriella eggeri* Finlay and non numerous secreted forms *Bulimina aksuatica* Moroz., *Bolivina antegressa* Subb., *Angulogerina angulosa* (Will.). From the same stratigraphic interval in borehole 1-p Armyansk (the north of Crimean Plain) E.K. Schutzkaya [89] also reported *Ammomarginulina* sp., *Sp. eocaenica* Cushm., *Reophax* sp., *Haplophragmoides* sp., *Glomospira charoides* (Park. et Jon.).

Another, the second, BF assemblage was determined by I.D. Konenkova [27, 33] in boreholes drilled near Novo Kievka village and Mayachka of the Kherson area. It includes *Ammodiscus incertus* (Orb.), *Glomospira charoides* (Park. et Jon.), *Textularia varians* Glaessn., *Gaudryina navarroana* Cushm.*, *Dorothia postbuletta* Balakhm., *Marginulina eofragaria*

Balakhm.*, *M. mexicana* Cushm., *Nodosaria affinis* Reuss, *N. latejugata* (Guemb.), *Anomalina granosa* (Hantk.), *An. acuta* Plumm., *Cibicides beatus* Martin*, *C. eocaenus* (Guemb.), *Asterigerina bartoniana* (ten Dam). Previously similar BF association O.K. Kaptarenko-Chernousova had identified in borehole near Novo-Alekseyevka of the Henichesk area [15, 33]. This BF assemblage includes characterizing species, marked by (*) in the list, of the Bakhchisaraian Regiostage of the southern Ukraine.

Deposits with the described BF assemblage correspond to planktic foraminifera of zone Morozovella subbotinae s. l. [27, 33] and calcareous nannofossils zone NP 11 [5, 6], characterizing the Bakhchisaraian Regiostage.

From beds with *Assilina placentula* E.K. Schutzkaya [89] determined shallow-water BF association with *Marginulina fragaria* (Guemb.), *Cibicides beatus* Martin, *C. productus* (Terq.). Planktic foraminifera of the beds, indicating the uppermost part of zone Morozovella subbotinae s. l., and calcareous nannofossils, corresponding to zone NP 12 [5, 6], characterize upper part of Bakhchisaraian Regiostage.

Author's notes. BF association of the Bakhchisaraian deposits of the NPBSR consists of species known from Paleocene of the CCR and those ones appearing in Eocene, namely *Marginulinopsis eofragaria* Balakhm., *Nodosaria affinis* Reuss, *Heterolepa eocaena* (Guemb.), *Cibicidoides beatus* (Martin), *Asterigerina bartoniana* (ten Dam), *Bulimina aksuatica* Moroz. Also this association includes index-species of Lower Ypresian interregional zone Pseudogaudryina externa of the CCR [9] (see fig. 2), which was previously defined as *Gaudryina navarroana* Cushm. [9]. Species *Pseudogaudryina externa* Bugr., *Marginulinopsis eofragaria* Balakhm. and *Cibicidoides beatus* (Martin) constitute characteristic BF association the Bakhchisaraian Regiostage in the NPBSR [64, 90] (see table).

Simferopolian Regional Stage. Up to the seventies of XX century from Simferopolian deposits of the NPBSR three foraminifera assemblages, from deep-water to the most shallow-water, had been distinguished.

The first BF assemblage from Simferopolian deposits of the region is connected with beds with large foraminifers, *Acarinina bullbrooki*, *Morozovella aragonensis* [64]. Due to investigations of A.M. Voloshina [10], A.P. Pechenkina [40], I.D. Konenkova [27], E.K. Schutzkaya [89] the complex with dominating planktic foraminifera of zonal interval Morozovella aragonensis – Acarinina bullbrooki and accompanying benthic species *Clavulina golubjatnikovi* Schutzk., *Pseudogaudryina pseudonavarroana* (Balakhm.), *Heterostomella dalmatina* (Liebus), *Marsonella indentata* (Cushm. et Jarv.), *Spiroplectammina carinatiformis* Moroz., *Gyroidina micheliniana* Orb., *Anomalina acuta* Plumm., *An. granosa* (Hantk.), *An. ammophilla* Guemb., *Cibicides perlucides* Nutt., *C. eocaenus* Guemb., *C. ungerianus* Orb. was determined in the south of NPBSR.

Author's notes. The assemblage includes characterizing species of the Simferopolian Regiostage of the southern Ukraine (see table), namely *Pseudogaudryina pseudonavarroana* (Balakhm.), *Falsoplanulina ammophila* (Guemb.), and characterizing species of upper Ypresian – lower Lutetian interregional superzone Pseudogaudryina pseudonavarroana of the CCR [9], namely *Spiroplectammina carinatiformis* Moroz., *Pseudogaudryina pseudonavarroana* (Balakhm.), *Clavulinoides golubjatnikovi* Schutzk., *Paragaudryina dalmatina* (Liebus), *Heterolepa eocaena* (Guemb.) (see fig. 2).

The second BF assemblage. Relatively more shallow-water foraminifera associations characterize beds with *Nummulites distans* widely spreading in the NPBSR [18, 23, 34, 35, 40, 52, 100]. Ye.Ya Kraeva [49] gave detailed characteristic the associations with BF prevailing over planktic foraminifera. She noted that foraminifera complex of the nummulitic beds are changeable both systematic composition and number of specimens of each species. The complex includes *Clavulinoides australis* Balakhm. et Sapers., *Articulina terquemi* Cushm., *Marginulinopsis decoratus* (Reuss), *Lenticulina laticostata* (Tutkow.), *L. arcuato-striata* (Tutkow.), *Dentalina bulbosa* Halk., *Anomalina acuta acuta* (Plumm.), *Heterolepa eocaena* (Guemb.), *Asterigerina rotula* Kaufm., *As. stelligera* Kraeva, *Siphonina lamarckana* Cushm., *S. kaptarenkae* Kraeva, *Alabamina tonica* Kraeva, *Al. wilcoxensis* Toulm., *Svratkina perlata* (Andr.), *Cibicides westi arguta*

(N. Byk.), *C. hadjibulakensis* N. Byk., *C. carinatus* (Terq.), *C. disjunctus* (Terq.), *Hanzawaia producta* (Terq.), *Karreria fallax* Rzeh., *Nonion* ex gr. *graniferum* (Terq.), *Pararotalia trochidiformis* (Lam.), *Reusella limbata* (Terq.), *Uvigerina proboscidea* Schwag., *Angulogerina muralis* Terq., *Bolivina brabantica* Kaasch., etc. In the NPBSR the beds with *Nummulites distans* are characterized by planktic foraminifera of zonal interval Morozovella aragonensis (upper part) – Acarinina bullbrooki [27, 45] and calcareous nannofossils of NP 13 and NP 14 zones [6, 113], defining the Simferopolian Regiostage of the southern Ukraine.

The third BF assemblage has been described by Ye.Ya. Kraeva [49], who marked that the most shallow-water BF associations of simferopolian nummulitic beds in the NPBSR differ by pure systematic composition but abundant specimens *Cibicides disjunctus* (Terq.), *Asterigerina rotula* Kaufm., *As. stelligera* Kraeva, *Alabamina tonica* Kraeva, *Rotalia* ex gr. *trochidiformis* (Lam.), *Reussella limbata* (Terq.), others.

Author's notes. The small BF assemblages of the beds with *Nummulites distans* of Simferopolian Regiostage the NPBSR I propose to distinguishe as assemblage-zone Vaginulinopsis decorata, Asterigerina stelligera (see fig. 2). The zone includes characterizing BF species determing this regiostage in the region (see table). Due to presence *Robulus laticostatus* (Tutkow.), *Vaginulinopsis decorata* (Reuss), *Cibicidina dampelae* (N. Byk. et Chram.), *Falsoplanulina ammophila* (Guemb.), *Asterigerina stelligera* Kraeva, *Siphonina kaptarenkae* Kraeva, *Eponides polygonus* (Le Calvez), *Alabamina tonica* Kraeva, *Baggina valvulineriaformis* (N. Byk.), *Cancris plana* (Balakhm.), *Bulimina aksuatica* Moroz., *Kolesnikovella elongata* (Halk.) this zone Vaginulinopsis decorata, Asterigerina stelligera should be considered shallow-water stratigraphic analogue of upper Ypresian – lower Lutetian interregional superzone Pseudogaudryina pseudonavarroana of the CCR [9].

Novopavlovkian Regional Stage. Beds with *Robulus kuberlinus* and *Uvigerina bykovae ucrainica.* These beds were firstly distinguished by Ye.Ya. Kraeva [97] as "zone Hopkinsina bykovae ukrainica" corresponding to sediments of the Kuberla Horizon of the NPBSR and spreading into the southern slope of US. In the Stratigraphic Scheme of Ukraine [64, 90] the described BF assemblage is named beds with *Lenticulina kuberlina* and *Hopkinsina bykovae ukrainica* of the lower Novopavlopkian Regional Subhorizon.

In the mentioned article Ye.Ya. Kraeva [97] gave detailed description of zonal BF assemblage consisting of *Paragaudryina pseudonavarroana* Balakhm., *Heterostomella dalmatina* (Liebus), *Clavulina cylindrica* Hantk., *Cl. szaboi* (Hantk.), *Lenticulina romeri* (Reuss), *L. laticostata* Tutkow., *L. kuberlina* J. Nik., *Anomalina acuta acuta* Plumm., *An. neelyi* Jenn., *Cibicidoides biumbonatus* A. et K. Furs., *Alabamina wilcoxensis* Toulm., *Pseudoparella culter* (Park. et Jon.), *Siphonina kaptarenkae* Kraeva, *Cibicides ammophylus* (Guemb.), *C. westi westi* Howe, *C. ungerianus* (Orb.), *Asterigerina stelligera* Kraeva, *As. rotula* Kaufm., *Bifarina millepunctata* Tutkow., *Bulimina arostrata* Balakhm., *Bul.* aff. *mitgarziana* Balakhm., *Hopkinsina bykovae ukrainica* Kraeva, *Uvigerina proboscidae* Schwag., *Angulogerina elongata* (Halk.). She marked [97] that the most of foraminifera of the beds with *Hopkinsina bykovae ukrainica* are known from Simferopolian Horizon and Kuberla Horizon (now Lower Novopavlovkian Regional Substage). She determined lower limit of the beds by appearance of *Hopkinsina bykovae ucrainica* Kraeva, *Bulimina arostrata* Balakhm., *Siphonina kaptarenkae* Kraeva [52, 93. To my mind in some sections the lower part of beds may correspond to upper part of Simpheropolian Regiostage. In borehole Mirnoe, drilled not far from Odessa, Ye.Ya. Kraeva and T.A. Menkes [109] determined foraminifera assemblage of the Kuberla Horizon in interval 452-448 m from sandy marls containing large foraminifera of beds with *Nummulites distans* indicating Simferopolian Regiostage. Upper limit of the beds with *Hopkinsina bykovae ukrainica* Ye.Ya. Kraeva determined by appearance *Textularia carinatiformis* Moroz., *Bulimina sculptilis* Cushm., *Uvigerina hispida* Schwag. and planktic foraminifera *Globigerinoides subconglobatus* Schutzk., *Hantkenina alabamensis* Cushm. marking the Keresta Horizon (now the Upper Novopavlovkian Regional Substage).

Researchers also noted increasing thickness of beds with *Hopkinsina bykovae ukrainica* of the Kuberla Horison from the south to north in the NPBSR [52, 67, 97].

It is interesting to note that in Ye.Ya. Kraeva's publications of middle 50-s – beginning 60-s years of the XX century this BF assemblage has not been distinguished. It was included into "lagenids-globorotaliids zone" in the Tokmak-Melitolpol area of the eastern part of the NPBSR, "zone Hantkenina alabamensis (globorotaliids)" in the Odessa-Kherson area of the western part of the NPBSR [41, 43, 44] or has been considered in Middle Eocene deposits (now Simpheropolian Regiostage).

N.G. Savenko [83] distinguished foraminifera assemblage of the Kuberla Horizon in the NPBSR as biostratigraphic "zone Lenticulina kuberlina, Acarinina pentacamerata" in boreholes of the central and eastern parts of the region, "zone Acarinina pentacamerata, Acarinina interposita" of the south-west of the region. She determined that in foraminifera assemblages of the Kuberla Horizon in the north of NPBSR the secreted benthic species prevail over planktic and arenaceous ones. Among BF representatives Nodosariidae, Asterigerinidae and Buliminidae dominate. The most numerous are *Textularia pishvanovae* A. et K. Furs., *Lenticulina kuberlina* J. Nik., *Cibicides perlucides* Nutt. var. *kasahstanensis* J. Nik., *Bulimina arostrata* Balakhm., *Hopkinsina bykovae ukrainica* Kraeva, *Uvigerina proboscidae* Schwag.

Due to investigations of Ye.Ya. Kraeva [45, 55, 85], Yu.P. Nikitina [65], N.G. Savenko [11, 82, 83, 100, 101] and I.D. Konenkova [22, 35] systematic composition of the beds was completed by *Marsonella indentata* (Cushm. et Jarv.), *Hydromylina rutteni* Puyt., *Anomalina postvulgaris* J. Nik., *Cibicides perlucides* (Nutt.), *Heterolepa pygmeuformis* (Kraeva), *H. porosus* (Kraeva), *Eponides jacksonensis* Cushm., *Virgulina dibollensis* Cushm. et Appl., *Sporobulimina eocaena* N. Byk., *Bulimina mitgarziana* Balakhm., *Candella ignara* N. Byk.

As a result restudying samples from boreholes drilled on the Odessa area Ye.Ya. Kraeva and T.A. Menkes [109] redefined BF of the Kuberla Horizon and supplemented the species composition with *Textularia pishvanovae* (A. et K. Furs.), *Clavulinoides golubjatnikov*i Schutzk., *Marginulina fragaria* (Guemb.), *Lenticulina dimorpha* (Tutkow.), *Anomalina granosa* (Hantk.), *Brotzenella pseudoacuta* (Nakk.), *Cibicidoides hadjibulakensis* (N. Byk.), *Heterolepa eocaena* (Guemb.), *Eponides subumbonatus* Mjatl., *Alabamina tonica* Kraeva, *Cibicides lobatulus* (Walk. et Jac.), *Trifarina bradyi* Cushm., *Dymia idnara* N. Byk.

These beds spread on the south of US where they are known as "light marls with large lagenids, buliminids and *Clavulina*". Previously this BF assemblage was described firstly by M.V. Yartseva as "complex with large lagenids, buliminids, anomalinids and rotaliids" from light-yellow marls of the middle part of the Kiev Suite in the Ingulets river basin [71]. Researcher noted that planktic foraminifera association of the marls is characteristic for "zone Globigerinoides conglobatus" of the northern Fore-Caucasus (now – Globigerinatheka subsonglobata, Hantkenina alabamensis Zone of the Upper Novopavlovkian Regional Substage in the southern Ukraine).

Later Ye.Ya. Kraeva [111] attributed the light marls with *Spiroplectammina carinatiformis* Mor., large lagenids, buliminids of the south of the US to the Keresta Horizon.

M.V. Yartseva, Ye.Ya. Kraeva [108] have revised foraminifers of Eocene sediments the southern slope of US. They distinguished the described BF association as the fourth complex with numerous and diverse lagenids and buliminids, large arenaceous *Clavulina* and *Clavulinoides*. Researchers correlate it with Globigerina turkmenica and Globigerina instabilis Zone of the Kuma Horizon and perhaps with upper part of lone Globigerapsis subconglobatus and Hantkenina alabamensis of the Keresta Horizon.

Based on planktic foraminifera of zone Globigerinatheka subconglobata T.S. Ryabokon [75] precised stratigraphic position of that BF complex and attributed the beds to the Keresta Horizon (now the Upper Novopavlonkian).

So, in the NPBSR the beds with *Robulus kuberlinus*, *Uvigerina bykovae ukrainica* correspond to planktic foraminifera zone Acarinina rotundimarginata [52, 55, 97]. On the southern slope of US the beds are some younger and correspond to zone Globigerinatheka subconglobata, Hantkenina alabamensis [75, 108]. In the lower part of the beds' section the large foraminifera beds with *Nummulites variolarius* are distinguished. Calcareous nannofossils of zonal interval NP 15-NP 16 characterize beds with *Robulus kuberlinus*, *Uvigerina bykovae ukrainica*.

Author's notes. Small BF assemblage of the desribed beds should be considered as assemblage-zone Robulus kuberlinus, Uvigerina bykovae ukrainica, characterizing the Novopavlovkian Regiostage in the NPBSR (fig. 3). Due to presence *Spiroplectammina carinatiformis* Moroz., *Sp. pishvanovae* A. et K. Furs., *Paragaudryina dalmatina* (Liebus), *Pseudogaudryina pseudonavarroana* Balakhm., *Robulus kuberlinis* (J.Nik.), *R. dualis* Bugr., *R. laticostatus* (Tutkow.), *Marginulinopsis fragaria* (Guemb.), *Cibicidoides biumbonatus* A. et K. Furs., *Cib. hadjibulakensis* (N. Byk.), *Heterolepa eocaena* (Guemb.), *Alabamina tonica* Kraeva, *Siphonina kaptarenkae* Kraeva, *Falsoplanulina ammophila* (Guemb.), *Asterigerina stelligera* Kraeva, *Sporobulimina eocaena* N. Byk., *Uvigerina haspida* Schwag., *Uv. costellata* Moroz., *Trifarina bradyi* Cushm., *Dymia labrum* (Subb.), *Loxostomoides millepunctatus* (Tutkow.), zone Robulus kuberlinus and Uvigerina bykovae ukrainica of the NPBSR corresponds to Lutetian interregional zone Uvigerina costellata of the CCR [9]. On my opinion deposits of this zone reflects certain shelf facies of the Eocene basin within the NPBSR in Lutetian time.

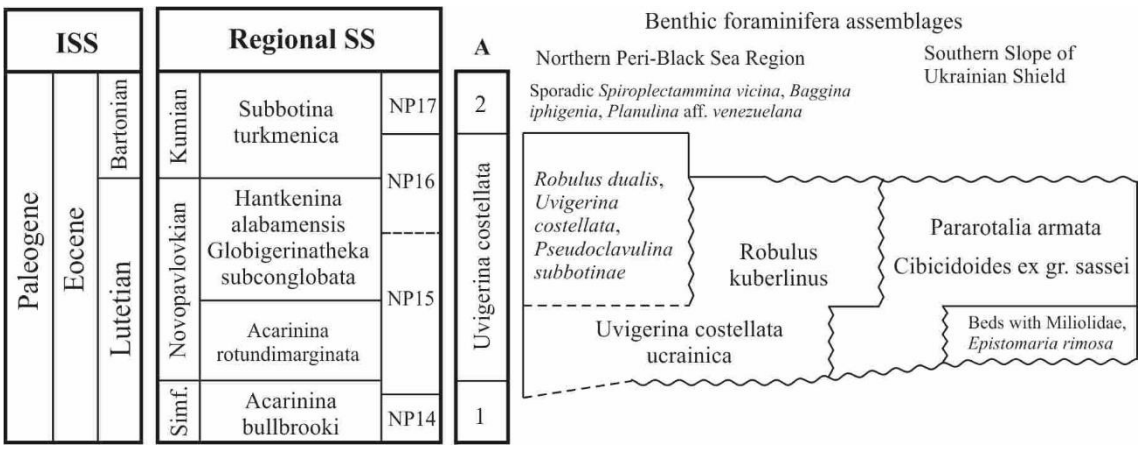

Fig. 3. Sequence and space-time relationships of small benthic foraminifera assemblages in Middle Eocene of the southern Ukraine

A - interregional benthic foraminifera zones of the Crimea-Caucasus Region [9, 39]: 1 - zone Pseudogaudryina pseudonavarroana; 2 - zone Haplophragmoides orfaensis

Small BF assemblages of beds with *Nummulites variolarius.* The first mentions about small BF of Eocene deposits of the southern slope of US are in articles of O.K. Kaptarenko-Chernousova [16] and M.V. Yartseva [104]. M.V. Yartseva [104] described distribution of foraminifera in Eocene section of the Nikopol area. She noted that beds with *Ostrea* are characterized by abundant *Cibicides carinatus* (Terq.), *Rotalia armata* (Orb.), decreasing quantity of miliolids and discorbiids, mass *Camerina* sp. (= *Nummulites* sp.). She correlated these beds with Ledian stage of Europe. In her later publications [71, 106] M.V. Yartseva gave more detailed characteristic of Eocene deposits with small nummulitids of the southern slope of US (basins of the Basavluk, Solenaia and Ingulets rivers). After M.V. Yartseva the characteristic feature of the beds is the presence large foraminifera *Nummulites variolarius* Lam., *Num. incrassatus* de la Harpe. In general, the small BF assemlage of these beds is distinguished by *Asterigerina*, Anomalinidae, *C. carinatus* (Terq.), *C. sassei* (Cole), *Rotalia armata* (Orb.).

In following years, mention and description of BF assemblage of beds with *Nummulites variolarius*, *Num. incrassatus* of the region are present in publications of Yu.P. Nikitina [65], Ye.Ya. Kraeva [111], I.D. Konenkova [7] and others.

Yu.P. Nikitina [65] for the southern slope of US reported two shallow-water associations: the first with *Rotalia armata* (Orb.), large Anomalinidae, Asterigerinidae; the second with numerous *Lenticulina inornata* (Orb.), *Cibicides kasahstanensis* J. Nik., *C.* ex gr. *sassei* Cole, *C.* ex gr. *rzehaki* (Grzyb.), *Nonion umbilicatulum* (Walk. et Jack.), *Rotalia armata* (Orb.), *Asterigerina* sp., *Virgulina dibollensis* Cushm. et Appl. She correlated these BF associations with "lagenids-

globorotaliids zone" of the Tokmak-Melitopol area (the eastern part of the NPBSR) [41, 44] and with the Keresta Horizon of Crimean Peninsula.

Ye.Ya. Kraeva [111] described the assemblage under consideration of the southern slope of the US as rich association of shallow-water foraminifers with abundant miliolids, nonionids, *Pararotalia armata* (Orb.), *Cibicides* sp., nummulitids.

Based on restudying foraminifers of Eocene deposits of the southern slope of the US, M.V. Yartseva, Ye.Ya. Kraeva [108] identified BF association of beds with *Nummulites variolarius* as "the third complex" with numerous small *Num. gandinus* Rz. (= *Num. variolarius* var *gandina* Rz.). In this association along with many species of "the second complex" (assemblage with miliolids and *Epistomaria semi-marginata*) are constantly present *Clavulina parisiensis* Orb., *Eponides polygonus* Le Calv., *Pararotalia armata* (Orb.), *Cibicides robustus* Le Calvez, *Cycloloculina costellata* (Terq.), *Asterigerina* sp., *Robertina ovigera* (Terq.), *Angulogerina muralis* (Terq.), rare miliolids. For "the third complex" M.V. Yartseva, Ye.Ya. Kraeva also designated *Quinqueloculina nicopolica* Jarz., *Triloculina trigonula* (Lam.), *Tr. soljenica* Jarz., *Spiroloculina carinata* Le Calvez, *Sp. contorta* Le Calvez, *Discorbis rotata* (Terq.), *Eponides schreibersi* (Orb.), *Rosalina limbata* (Terq.), *Cancris subconicus* (Terq.), *Cibicides carinatus* (Terq.), *Nonion affine* (Reuss), *N. commune* (Orb.), *Elphidium hiltermanni* Hagn., *Tubuligenerina tubulifera* (Park. et Jon.), *Bolivina crenulata* Cushm., others. Researchers considered deposits containing "the third complex" of BF an analogue the Lutetian and dated them middle Eocene.

I.D. Konenkova [13], L.A. Digas [63], T.S. Ryabokon [74, 76, 77, 114], T.A. Ivanova [7] also have studied taxonomic composition of association of small BF of the beds with *Nummulites variolarius* of the southern slope of US. They supplemented the species composition of beds with *Nummulites variolarius* with *Textularia conica* Orb., *Spiroplectammina haueri* (Orb.), *Robulus crassus* (Orb.), *R. inornatus* (Orb.), *R. laticostatus* (Tutkow.), *Dentalina acuta* Orb., *D. badenensis* (Orb.), *D. inornata* Orb., *Nodosaria spinescens* Reuss, *Anomalinoides alazanensis* (Nutt.), *Cibicidoides* aff. *extremus* (Schutzk.), *Cib. karpaticus* Mjatl., *Cib.* ex gr. *sassei* (Cole), *Cib. hadjibulakensis* (N.Byk.), *Heterolepa eocaena* (Guemb.), *H. pygmea* (Hantk.), *H. porosa* (Kraeva), *Hanzawaia producta* (Terq.), *Cycloloculina eocaenica* Terq., *C. punctata* Terq., *C. flabellum* Terq., *Melonis umbilicatulus* (Orb.), *M. dosularensis* (Chalil.), *Pullenia quinqueloba* Reuss, *Valvulineria palmarealensis* (Nutt.), *Asterigerina rotula* Kaufm., *As. stelligera* Kraeva, *As. jartzevae* Konen, *Eoeponidella lobata* Sztrakos., *Ammonia stellata* (Kraeva), *Am. proprinqua* (Reuss), *Pararotalia spinigera* Le Calvez, *P. audouini* (Orb.), *Porozononion subnodosum* (Munst.), *Canalifera* aff. *microgranulosa* (Gall. et Wiss.), *Bulumina woodwardi* Tutkow., *Fursenkoina dibollensis* (Cushm. et Appl.), *Kolesnikovella ignara* N.Byk., *Reussella terquemi* Cushm., *R. obtusa* (Terq.), *Lamarckina ovula* Le Calvez, etc. T.S. Ryabokon [75-77] described diversity of small BF associations of these beds differing by dominant *Pararotalia*, *Melonis*, *Robulus*, Polymorphinidae, Cibicidae.

Author's notes. Small BF assemblages of beds with *Nummulites variolarius* on the southern slope of US should be regarded as assemblage-zone Pararotalia armata, Cibicidoides ex gr. sassei. Due to presence *Robulus laticostatus* (Tutkow.), *Cibicidoides carinatus* (Terq.), *Cib. hajibulakensis* N. Byk., *Heterolepa eocaena* (Guemb.), *Hanzawaia producta* (Terq.), *Asterigerina rotula* Kaufm., *A. stelligera* Kraeva and other species, BF assemblages of beds with *Num. variolarius* (zone Pararotalia armata, Cibicidoides ex gr. sassei) of depressions of the southern slope of US are similar to BF complex of beds with *Num. distans* (zone Vaginulinopsis decorata, Asterigerina stelligera of the Simpheropolian Regiostage in the article). But deposists of zone Pararotalia armata, Cibicidoides ex gr. sassei are some younger because they contain middle-upper Lutetian large foraminifera of zone Num. variolarius [112], rare planktic foraminifera of zone Acarinina rotundimarginata [7] and calcareous nannofossils of zonal interval NP 15-NP 16 [7, 76, 94], determing the Novopavlovkian Regiostage of the southern Ukraine. Marking shallow-marine depositional environments of the Eocene basin within the southern slope of US in the Novopavlovkian time (middle Eocene), zone Pararotalia armata, Cibicidoides ex gr. sassei is an stratigraphic analogue of zones Robulus kuberlinus, Uvigerina bykovae ukrainica of the NPBSR (see fig. 3). This conclusion is proved by common species *Spiroplectammina pishvanovae* A. et

K. Furs., *Robulus crassus* (Orb.), *R. laticostatus* (Tutkow.), *R. inornatus* (Orb.), *R. pseudoromeri* Schwemb., *Anomalinoides alazanensis* (Nutt.), *Cibicidoides karpaticus* Mjatl., *C. biumbonatus* A. et K. Furs., *C. hadjibulakensis* N.Byk., *Heterolepa eocaena* (Guemb.), *H. porosa* (Kraeva), *Melonis umbilicatulus* (Orb.), *M. affine* (Reuss), *Pullenia quinqueloba* Reuss, *Ammonia* ? *stellata* (Kraeva), *Asterigerina stelligera* Kraeva, *Sporobulimina eocaena* N. Byk., *Fursenkoina dibollensis* (Cushm. et Appl.).

Beds with Miliolidae and *Epistomaria rimosa.* M.V. Yartseva [104-106] was the first who described association with large and various miliolids, polymorphinids from upper part of "sub-ostrea beds" in the Nikopol section on the southern slope of US. She noted predominance Miliolidae, *Elphidium*, presence *Epistomaria semimarginata* (Orb.), *Discorbis* aff. *limbatus* (Terq.), *Dis. parisiensis* (Orb.) in the complex. So M.V. Yartseva [71] named it as "assemblage with abundante miliolids and polymorphinids, with *Ep. semimarginata* d'Orb" or "grey calcareous clays with *Ep. semimarginata*".

Later as a result of restudying foraminifera from Eocene deposits of the southern slope of US, M.V. Yartseva and Ye.Ya. Kraeva [108] have distinguished the mentioned BF association as "the second complex" characterizing by abundance Miliolidae and permanent presence *Epistomaria rimosa* (Park. et Jon.). This complex includes *Quinqueloculina nicopolica* Jarz., *Q. carinata* Orb.*, *Triloculina angularis* Orb.*, *Tr. gibba* Orb.*, *Tr. trigonula* (Lam.)*, *Tr. soljenica* Jarz., *Spiroloculina carinata* Le Calvez*, *Sp. tricarinata* Terq.*, *Sp. contorta* Le Calvez*, *Sp. perforata* Orb.*, *Sp.* cf. *cylindrica* Lam.*, *Sp*. cf. *pedum* Orb., *Articulina ferussaci* (Orb.)*, *Ar.* cf. *nitida* Orb.*, *Vertebralina contracta* Terq.*, *V.* ex gr. *striata* Orb.*, *Biloculina bulloides* (Orb.)*, *B. ringans* Orb.*, *Nodobaculariella jartzevae* Bogd., *Fissurina orbignyana* (Seg.) *tricarinata* (Terq.)*, *Globulina gibba* Orb.*, *Guttulina irregularis* (Orb.)*, *Anomalina auris* Le Calvez*, *Hanzawaia producta* (Terq.)*, *Cibicides carinatus* (Terq.)*, *Discorbis alata* Le Calvez*, *Dis. vesicularis* Lam.*, *Dis. rotata* (Terq.)*, *Eponides schreibersii* (Orb.), *Rosalina limbata* Terq.*, *R.* ex gr. *humilis* Le Calvez*, *Cancris subconicus* (Terq.)*, *Valvulineria* ex gr. *lamellosa* Terq.*, *Nonion labradoricus* Davs., *N.* ex gr. *commune* (Orb.), *Elphidium hiltermanni* Hagn.*, *El.* ex gr. *laeve* (Orb.)*, *Pararotalia armata* (Orb.)*, *P. inermis* (Terq.)*, *Epistomaria rimosa* (Park. et Jon.)*, *Bulimina ovigera* Terq.*, *Bul. elongata* Le Calvez, non Orb.*, *Buliminella pulchra* Terq.*, *Reusella terquemi* Cushm.* Researchers dated the second BF complex late Lutetian based on similar composition of species with the Paris basin (marked by * in the list).

T.S. Ryabokon [75-77] gave historical review of stratigraphical interpretation of beds with miliolids. She supplemented the species composition of the beds with *Robulus inornatus* (Orb.), *Nonion commune* (Orb.), *Melonis affine* (Reuss), *M. umbilicatulus* (Orb.), *Cibicidoides karpaticus* Mjatl., *Eponides polygonus* (Le Calv.), *Baggina subconica* (Terq.), *Neoconorbina orbignyana* (Brady), *Asterigerina stelligera* Kraeva, *Cribrononoin onerosum* (Bogd.), *Porosononion subnodosum* (Munst.), *Reussella terquemi* Cushm., *Tubulogenerina tubulifera* (Park. et Jon.), *Robertina germanica* Cushm. et Park., *Bolivina crenulata* Cushm., etc. Researcher described variety of BF associations namely complex with Miliolidae, complex with *Ammonia*, complex with Polymorphinidae, complex with *Lobatula*. T.S. Ryabokon [75] compared the beds with Miliolidae and *Epistomaria rimosa* the Kuberla Horizon (= Lower Novopavlovkian Regional Substage) of the southern Ukraine. She also confirmed correlation the beds with Miliolidae and *Epistomaria rimosa* of the Basavluk depression of the southern slope of US with middle-upper Lutetian of the Paris basin. T.S. Ryabokon noted that by taxonomic composition the BF assemblages of the beds differ sharply from known BF associations of middle Eocene deposits the NPBSR and the Dnieper-Donets Depression. After her the common species with BF association of the Novopavlovkian of the NPBSR are *Lenticulina rostellata* Kraeva, *Cibicidoides hagjibulakensis* N. Byk., *Heterolepa porosa* Kraeva, *Asterigerina stelligera* Kraeva, *As. jartzevae* Konen., *Cibicidina arguta* (N. Byk.), *Hanzawaia producta* (Terq.), *Ammonia* ? *stellata* (Kraeva), *Kolesnikovella ignara* N. Byk., *Bolivina arta* Mact. Also she noted the predominance Miliolidae, Polymorphinidae.

Author's notes. Beds with Miliolidae and *Epistomaria rimosa* characterize shallow-marine depositional environments of the Eocene sea within depressions on the southern slope of US in middle Lutetian time (see fig. 3).

Novopavlovkian – Kumian Regional Stages. BF assemblages with *Robulus dualis* Bugr., *Uvigerina costellata* Moroz., *Pseudoclavulina subbotinae* J. Nik. are connected with marls and clay limestones in section of the south part of the NPBSR. These deposits are accompanied with planktic foraminifera of zone Globigerinatheka subconglobata, Hantkenina alabamensis characterizing Upper Novopavlovkian Regional Substage. Aslo the associations are known from lithologically similar grey-greenish marls with *Subbotina turcmenica* (Chal.), *Acarinina bullbrooki* (Bolli) marking the lower part of the Kumian Regiostage in the region. As biostratigraphic unit (zones or beds with foraminifera) these assemlages were not distinguished by prevoius researchers. But similar associations of small BF were described by Ye.Ya. Kraeva [41, 44] in sections of the NPBSR as "lagenids-globigerinids zone" in the Tokmak-Melitopol area, as "zone Globigerina apertura and Hantkenina alabamensis" in the Razdelnaya area and as "globigerinids zone" in the Odessa-Kherson area. Information about taxonomic composition of BF associations of the Keresta and Kuma Horizons also presents in publications of N.G. Savenko [82, 83, 101] and Ye.Ya. Kraeva [53, 55].

The assemblage, be named in the article as beds with *Robulus dualis*, *Uvigerina costellata*, *Pseudoclavulina subbotinae*, includes *Spiroplectammina carinatiformis* Mor., *Sp pishvanovae* (A. et K. Furs.), *Paragaudryina dalmatina* (Liebus.), *Gaudryina asiphonia* Andr., *Clavulinoides szaboi* (Hantk.), *Pseudoclavulina subbotinae* J. Nik.), *Robulus dualis* Bugr. (= *dimorpha* (Tutkow.)), *R. limbosus* (Reuss), *R. laticostatus* (Tutkow.), *R. grodnensis* (A. et K. Furs.), *Lenticulina parvula* Kraeva, *Marginulinopsis fragaria* (Guemb.), *M. pseudosetosa* (Moroz.), *Frondicularia tenuissima* Hantk., *Nodosaria bacillum* Defr., *Siphonodosaria annulifera* (Cushm. et Berm.), *Anomalinoides affinis* (Hantk.), *A. alazanensis* Nutt., *Brotzenella acuta taurica* (Sam.), *Br. turkmenica* Bugr., *Cibicidoides perlucidus* (Nutt.), *Cib. ungerianus* (Orb.), *Heterolepa pygmea* (Hantk.), *H. eocaena* (Guemb.), *H. biumbonata* (A. et K. Furs.), *Valvulineria palmarealensis* Nutt., *Gyroidinoides soldanii* (Orb.), *Svratkina perlata* (Andr.), *Oridorsalis umbonatus* (Reuss), *Siphonina kaptarenkae* Kraeva, *S. subreticulata* Mjatl., *Alabamina almaensis* (Sam.), *Al. wilcoxensis* Toulm., *Falsoplanulina ammophila* (Guemb.), *F. cushmani* (Nutt.), *Planulina costata* (Hantk.), *Bulimina sculptilis* Cushm., *Bul. aksuatica* Moroz., *Bul. inflata* Seg., *Globobulimina ovata* (Subb., non Orb.), *Fursenkoina dibollensis* (Cushm. et Appl.), *Uvigerina proboscidea* Schwag., *Uv. hispida* Schwag., *Uv. costellata* Mor., *Uv. jacksonensis* Cushm., *Uv. cocoaensis* Cushm., *Bolivina pusilla* Schw., *B. antegressa* Subb., *B. microlancetiformis* Subb., *B. asiatica* Moroz., *Trifarina bradyi* Cushm., *Candella labrum* (Subb.), *Kolesnikovella elongata* (Halk.), *Angulogerina wilcoxensis* Cushm. et Appl., *Loxostomoides millepunctatus* (Tutkow.), etc.

Author's notes. Presence *Spiroplectammina pishvanovae* A. et K. Furs., *Spiroplectammina carinatiformis* Moroz., *Pseudoclavulina subbotinae* J. Nik., *Robulus dualis* Bugr., *R. laticostatus* (Tutkow.), *R. grodnensis* (A. et K. Furs.), *Turkmenikaella infans* (Kraeva), *Brotzenella turkmenica* Bugr., *Cibicidoides biumbonatus* (A. et K. Furs.), *Siphonina kaptarenkae* Kraeva, *Falsoplanulina ammophila* (Guemb.), *Uvigerina costellata* Moroz., *Bulimina sculptilis* Cushm., *B. aksuatica* Moroz., *Bolivina microlancetiformis* Subb., *Dymia labrum* (Subb.), *Trifarina bradyi* Cushm., *Loxostomoides millepunctatus* (Tutkow.) and others proves correspondance the beds with *Robulus dualis*, *Uvigerina costellata*, *Pseudoclavuluna subbotinae* to middle Eocene interregional zone Uvigerina costellata of the CCR and regional zone Robulus dualis of the Russian Platform [9] (see fig. 3).

Almian Regional Stage. Despite numerous and good works on identification and description Upper Eocene foraminifera assemblages of the NPBSR the BF biostratigraphy of Priabonain section remains still non clear and sometimes confuse due to facies diversity of sediments.

Ye.Ya. Kraeva [41, 44], N.G. Savenko [83] have identified three foraminifera assemblages in Upper Eocene of the region. The first complex is connected with relatively deep-water marls and calcareous clays, the second one do with relatively shallow-water clay-silty deposits and the third one – the most shallow-water silty-sandy sediments. But as in these publications and as in others [30, 31, 35, 43, 52, 56, 65, 72, 88, 100, 101, 111] similar BF associations present under different names for various areas. Moreover, foraminifera associations with dominating arenaceous species from the upper part of the Eocene section previously as usual were attributed

to Lower Oligocene. New data on calcareous nannofossils and dinocysts be obtained from the sections up to the end of XX century have not lead to revision and redefinition stratigraphical position of the foraminifera assemblages.

Due to Ye.Ya. Kraeva, N.G. Savenko, A.P. Pechenkina and I.D. Konenkova's investigations the following BF assemblages may be distinguished today in the Almian Regiostage of the NPBSR, namely the beds with *Marginulinopsis infracompressus*, the beds with *Asterigerina*, *Nonion*, *Bolivina*, the beds with *Eoeponidella lucida* and *Cibicidoides salensis*, the beds with Anomalinacea, Miliolidae, *Asterigerina*, *Pararotalia*, the beds with arenaceous foraminifera, the beds with *Gaudryinopsis gracilis* and *Heterolepa almaensis* and the beds with *Angulogerina transcaspiensis.*

Beds with *Marginulinopsis infracompressus.* Ye.Ya. Kraeva [41, 44] was the first who identified foraminiferal assemblage of relatively deep-water marls of Upper Eocene of the region as "zone with Globigerinoides conglobatus" in sections of the Razdelnaya area (the southwestern part of the NPBSR), the Novo-Alekseevka (the Near Sivash) and Akimovka (the eastern part of the NPBSR). She described these deposits as those with numerous foraminifera, radiolarians and diatoms. After her it is characterized by numerous *Globigerinoides conglobatus* (Brady) and permanent presence *Marginulina infracompressa* (Thalm.), *Bulimina sculptilis* Cushm., *Uvigerina densecostata* Kapt. (msc.), *Uv. costellata* Moroz. Later N.G. Savenko [83] has confirmed Kraeva's results and also has marked numerous *Bolivina antegressa* Subb., various and numerous *Nodosaria*, *Lenticulina*, Buliminidae, Anomalinidae for the complex.

Ye.Ya. Kraeva [41, 44] and N.G. Savenko [83] considered this foraminifera assemblage to be an analogue of "zone with large globigerinids and Globigerinoides conglobatus" (syn.: zone Globigerapsis index) of the Alma Regional Horizon of Crimean Peninsula.

Similar BF associations from relatively shallow-water calcareous clay-silty deposits of Upper-Eocene, the researchers have identified under different names, namely "buliminids zone" in the Bolshaya Belozerka section [41, 44], "zone with Marginulina infracomressa" [41, 43, 44, 52], "zone Marginulina behmi" [83], an analogue of "zone Bolivina" or "horizon with *Marginulina*" [72], "zone Bolivina" [88, 111] and "zone Bolivina antegressa" [31].

The foraminifera assemblage of relatively shallow-water sediments is distinguished by predominance of benthic species and reduction of planktic ones, disappearance of *Globigerinoides conglobatus* (= *Globigerinatheka tropicalis* (Blow et Banner)) upward the section. BF associations of calcareous clay-silty deposits are similar to that of marls.

Ye.Ya. Kraeva [62, p. 7, table] renamed this foraminifera assemblage of Upper Eocene deposits of the NPBSR as "beds with *Marginulina infracompressa* and *Globigerinoides conglobatus*". Later L.A. Digas [8] has emphasized that "beds with *Marginulina infracompressa – Globigerapsis index*" in the central and western parts of the NPBSR occur conformable between "zone of planktic foraminifera" (Subbotina turcmenica zone of the Kumian Regional Stage) and "beds with *Asterigerina*, *Nonion*, *Bolivina*, *Nummulites*" (upper part of the Almian Regional Stage).

Upper Eocene beds with *Marginulinopsis infracompressus* of the NPBSR include *Paragaudryina dalmatina* (Liebus), *Cyclammina pseudocansellata* Chalil., *Clavulinoides szaboi* (Hantk.), *Cylindroclavulina colomi* Hagn, *Cyl. rudislosta* (Hantk.), *Marginulinopsis infracompressus* (Thalm.), *Marginulina behmi* Guemb., *Brotzenella acuta* (Plumm.) *taurica* (Sam.), *Anomalinoides alazanensis* Nutt., *Cibicidoides ungerianus* (Orb.), *Cib. perlucidus* Nutt., *Cib. biumbonatus* (A. et K. Furs.), *Alabamina almaensis* (Sam.), *Oridorsalis jacksonensis* (Nutt.), *O. umbonatus* (Reuss), *Baggina iphigenia* (Sam.), *Planulina costata* (Hantk.), *Bulimina sculptilis* Cushm., *Bul. aksuatica* Moroz., *Uvigerina jacksonensis* Cushm., *Uv. costellata* Moroz., *Uv. pygmea* Orb., *Uv. dubia* Kraeva, *Grammostomum nobilis* (Hantk.), *Bolivina antegressa* Subb., *Fursenkoina schreibersiana* (Cz.), *Globocassidulina globosa* (Hantk.) and others [31, 35, 44, 52, 55, 56, 59, 83, 88, 100, 101].

In the eastern part of the Near-Azov Region [31, 54] BF association of beds with *M. infracompressus* includes, except mentioned species, *Ammobaculites grossecameratus* Ter-Grig., *Spiroplectammina azovensis* J. Nik., *Vulvulina eocanena* Mont., *Frondicularia budensis* Hantk., *Frondicularia tenuissima* (Hantk.), *Robulus limbosus* (Reuss), *Anomalina granosa*

(Hantk.), *Cibicidoides bionus* (Schutzk.), *Cib. kugultaensis* (Schutzk.), *Cib. cribrosus* (A. et K. Furs.), *Heterolepa pygmea* (Guemb.), *Oridorsalis subumbonatus* (Mjatl.), *Melonis rotulis* (Chalil.), *Asterigerina falsilocularis* Subb., *A. crassa-suturata* Konen., *A. bracteata* Konen., *Turrilina alsatica* Andr., *Bulimina truncana* Guemb., *Neobulimina fraudenta* Subb., *Tergrigorjanzaella sectile* (Ter-Grig.), *Uvigerina dubia* Kraeva, *Uv. gardneri* Cushm., *Uv. jacksonensis delicatula* Kraeva, *Angulogerina angulosa* (Will.), *Rectuvigerina lacera* (Subb.), *Bolivina simplex* Balakhm., *B. adziderensis* Chalil., *B. pseudoaenariensis* Mjatl., *B. reticulataformis* Chalil., *B. praebinaensis* Chalil. *carinata* Chalil.

In the NPBSR the beds with *M. infracompressus* correspond to Upper Eocene planktic foraminifera zone Globigerinatheka tropicalis s.l. and calcareous nannofossils zonal interval NP 18–NP 19/20 [5, 6, 31, 36, 54, 56, 69, 83, 113] determing the Almian Regiostage of the southern Ukraine.

Author's notes. The described BF assemblage should be considered as assemblage-zone Marginulinopsis infracompressus as Ye.Ya. Kraeva has proposed previously. Zone Marginulinopsis infracompressus of the NPBSR (fig. 4) is an stratigraphic analogue of Priabonian interregional zone Planulina costata of the CCR [9] due to presence characterizing species *Clavulinoides szaboi* (Hantk.), *Cyclammina pseudocancellata* Chalil., *Marginulinopsis infracompressus* (Thalm.), *Marginulina behmi* Guemb., *Robulus limbosus* (Reuss), *Turkmenicaella kubinyi* (Hantk.), *Anomalina granosa* (Hantk.), *Anomalinoides alazanensis* (Hantk.), *Brotzenella taurica* (Sam.), *Cibicidoides tachtaensis* (Schutzk.), *Cib. kugultaensis* (Schutzk.), *Cib. bionus* (Schutzk.), *Heterolepa dutemplei* (Orb.), *H. pygmea* (Hantk.), *Svratkina perlata* (Andr.), *Alabamina almaensis* (Sam.), *Planulina costata* (Hantk.), *Grammostomum nobilis* (Hantk.), *Uvigerina jacksonensis* Cushm., *Bulimina truncana* Guemb., etc.

Some more shallow-water BF associations of the beds are described in I.D. Konenkova's works [30, 36]. The first association, the fourth, almian, complex in [36], I.D. Konenkova distinguished from Upper Eocene deposits of depressions of the southern part of US. It includes characterizing species of zone Marginulinopsis infracompressus and also shallow-water taxa *Triloculina tricarinata* (Terq.), *Asterigerina falcilocularis* Subb., *Elphidium subnodosum* (Roem.).

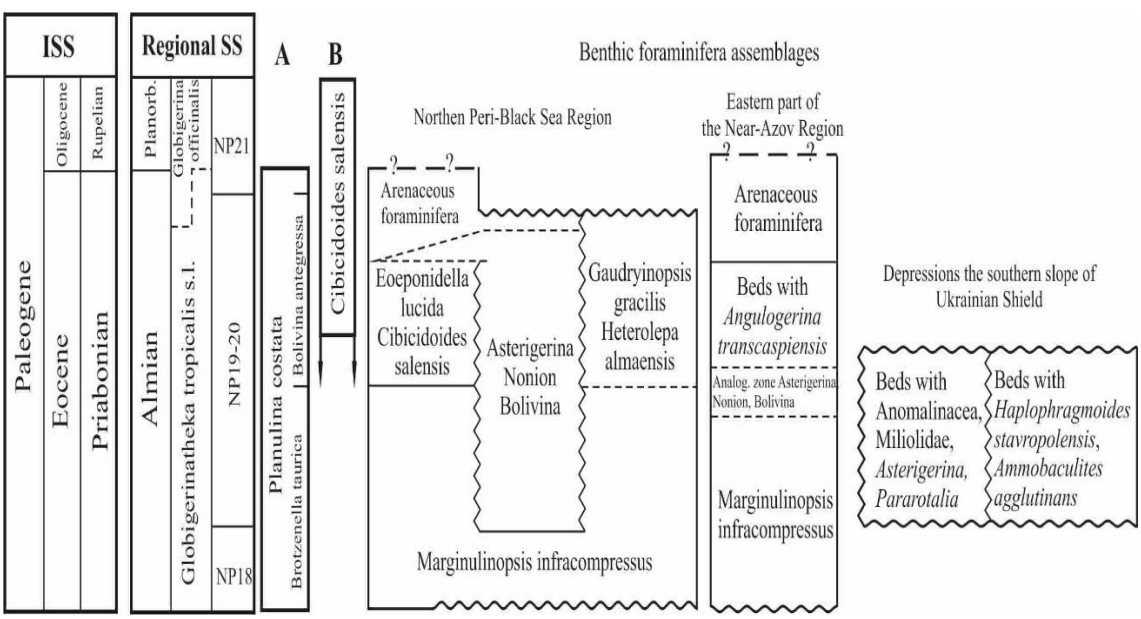

Fig. 4. Sequence and space-time relationships of small benthic foraminifera assemblages in Priabonian of the southern Ukraine

A - interregional benthic foraminifera zones of the Crimea-Caucasus Region [9];

B - regional benthic foraminifera zone of the Sal-Manych-river interflue [9]

The second assemblage, “zone Bolivina” in [30], I.D. Konenkova identified in borehole drilled in the Malaya Belozerka area (the north of eastern part of the NPBSR). These associations are characterized by various and numerous BF *Anomalina granosa* (Hantk.), *Cibicides tachtaensis* (Schutzk.), *C. kugultaensis* (Schutzk.), *C. bionus* Schutzk., *C. jankulaensis* (Nutt.), *C. ungerianus* Cushm., *Alabamina almaensis* (Sam.), *Al. perlata* (Andr.), *Eponides jacksonensis* Cushm., *Pullenia bulloides* Orb., *P. quinqueloba* Reuss, *Baggina iphigenia* (Sam.), *Oridorsalis praeumbonatus* (Mjatl.). Similar BF association from clays and silts of underlying manganese-ore bed of the Nikopol manganese-ore basin was defined by N.G. Savenko [14].

Beds with *Asterigerina*, Nonionidae, *Bolivina*, *Nummulites*. Ye.Ya. Kraeva [41, 43] has described small foraminifera assemblage as “zone Asterigerina and Nonion” from sediments with numerous nummulitids and mollusks of the Odessa-Kherson area section (central part of the NPBSR). She noted that the most abundant and characteristic species for this zone are *Eponides stellatus* Kraeva, *Asterigerina ambiqua* Kraeva. After Ye.Ya. Kraeva [43], the zonal association also is distinguished by permanent but not frequent species *Cibicides* aff. *pseudoungerianus* Cushm., *C.* aff. *oligocenicus* Sam., *Nonion umbilicatulus* Montf., *Pullenia quinqueloba* Reuss, *Eponides perlata* (Andr,), *Asterigerina bracteata* Cushm., *Turrilina alsatica* Andr., *Bolivina reticulata* Hantk. In her work [44] Ye.Ya. Kraeva renamed the assemblage as “zone with *Asterigerina*, *Nonion* and *Nummulites*”. Later she renamed it as “zone (beds) with *Asterigerina*, *Nonion*, *Bolivina*, *Nummulites*” [8, 62: p. 7, tabl.].

Similar BF association has been distinguished by A.P. Pechenkina [72] as “the fifth complex” characterizing interlayers of calcareous clays and aleurolites (silts) in the upper part of Paleogene section of the southwestern part of the NPBSR. She identified it as beds with shallow-water assemblage with calcareous foraminifera *Rotalia* sp., *Asterigerina* sp. (aff. *ambiqua* Kraeva), *Cibicides janschini* J. Nik., *C. sulzensis* (Herrm.), *C.* aff. *pseudoungerianus* Cushm., *C. tachtaensis* Schutzk., *Melonis* ex gr. *dozulaensis* (Chalil.), *Nonion* aff. *granosus* (Orb.), *Florilus* ex gr. *boueanus* (Orb.), *Baggina iphigenia* (Sam.), *Bolivina ovataeformis* Chalil., *B.* aff. *aenariensiformis* Mjatl., *Baggatella* sp., representatives of Lagenidae, Polymorphinidae, single *Nummulites ornignyi* (Gal.).

Later N.G. Savenko [82, 83, 100] determined that small BF assemblage of Upper Eocene beds with *Nummulites* and molluscs of the western part of the NPBSR are characterized by predominance of Asterigerinidae and Nonionidae. Among characteristic species she indicated *Cibicidoides sumsarensis* N. Byk. *ucrainicus* Kraeva, *Cib. roulensis* Kraeva, *Melonis dosularensis* (Chalil.), *Rotalia lithothamnica* (Uhlig), *Bolivina simplex* Balakhm. and *Asterigerina stelligera* Kraeva.

At the same time I.D. Konenkova [22] published detail biostratigraphic description “beds with *Asterigerina*, *Nonion* and *Nummulites*” of the same region. She noted that BF assemblage of the beds is distinguished by various species of Asterigerinidae, Nonionidae, Discorbidae and Anomalinidae. It includes *Asterigerina ambiqua* Kraeva, *A. crassa-suturata* Konen., *A. praefrankei* Konen., *A. jartzevae* Konen., *A. ambiqua* Kraeva forma *dorsoplana* Konen., *Melonis rotulus* (Chalil.), *Nonion nonionoides* (Andr.), *Baggina iphigenia* (Sam.), *Eponides stellatus* (Kraeva), *Cibicides bionus* Schutzk., *C. kugultaensis* Schutzk., *C.* ex gr. *karpaticus* Mjatl., *Bolivina microlancetiformis* Subb., *B.* ex gr *pusilla* Schwag. Small BF associations from the Western Near-Black Sea Region also contain *Marginulina behmi* (Reuss), *Cibicides* aff. *janschini* J. Nik., *C. dutemplei* (Orb.) *praecinatus* (Karr.), *C. jankulaensis* Schutzk., *C. kugultaensis* Schutzk., *C. tahtaensis* Schutzk., *C. carinatus* (Terq.), *Elphidium rohlshauseni* (Bandy), *Bolivina compta* Chalil., *B. compta carinata* Chalil.

As possible analogue of beds with *Asterigerina*, *Nonion* and *Nummulites* in the eastern part of Near-Azov Region, I.D.Konenkova [31] considers layers of noncalcareous silts containing numerous spongue spicules, radiolarians, diatomea and non numerous foraminifera *Ammobaculites grossecamerata* Ter-Grig., *Cylindroclavulina rudislosta* (Hantk.), *Nodosaria exilis* (Neug.), *Baggina iphigenia* (Sam.), *Melonis rotulis* (Chalil.), *Bolivina nobilis* Hantk., *B. reticulataformis* Chalil., *B. praebinaensis* Chalil. and rare *Asterigerina* and *Nonion*.

Author's notes. Small BF of descrided beds with *Nummulites* of the Almian Regiostage should be considered as assemblage-zone Asterigerina, Nonion, Bolivina as Ye.Ya. Kraeva has proposed previously. This zone corresponds to Priabonain large foraminifera beds with *Nummulites litoralis*, *N. concinnus*, *N. prestwichianus* [112]. Lower part of the nummulits beds is characterized by calcareous nannofossils of zonal interval NP 18–NP 19 [5, 6, 113] characterizing the Almian Regiostage. In Stratigraphic Scheme of Southern Ukraine these nummulits beds are considered to correspond to upper part of the Almian Regional Stage. BF assemblage of zone Asterigerina, Nonion, Bolivina in comparison with that of zone Marginulinopsis infracompressus indicates more shallow-water marine facies of the upper Eocene in the NPBSR (see fig. 4). It should be noted that BF assemblage of zone Asterigerina, Nonion, Bolivina of the western part of the NPBSR includes some characteristic species of zone Priabonian interregional Planulina costata of the CCR [9], namely *Marginulina behmi* (Reuss), *Cibicidoides sulzensis* (Herrm.), *Cib. tachtaensis* (Schutzk.), *Cib. bionus* (Schutzk.), *Turrilina alsatica* Andr., *Bolivina reticulata* (Hantk.), *B. compta* Chalil., etc.

Beds with *Eoeponidella lucida* and *Cibicidoides salensis.* Above marls of "zone Globigerinoides conglobatus" (= zone Globigerinatheka tropicalis; zone Marginulinopsis infracompressus in the article) in the Razdelnaya area section (the southwestern part of the NPBSR), Ye.Ya. Kraeva [41] has described foraminifera assemblage which she has named as "zone with Globigerina bulloides and arenaceous foraminifera". After her the main pecularities of this assemblage are as follows: considerable quantity of arenaceous foraminifera *Reophax* ex gr. *nodulosus* Br., *R. plana* Halk., *R. scalaria* Grzyb., *Proteonina fusiformis* Will., *Haplophragmoides eggeri* Cushm., *Clavulina szaboi* Hantk., *Heterostomella dalmatina* Liebus and others; impoverishing of speciments quantity and foraminifera species. As characterizing species of the zone she determined *Robulus carinatus* Kraeva, *Frondicularia budensis* (Hantk.), *Uvigerina densecostata* Kapt. (msc.), *Cassidulina globosa* Hantk., *Bifarina millepunctata* (Tutkow.), *Lingulina* sp.

At that time from the same region A.P. Pechenkina [40, 72] described resembling assemblage as "an analogue of zone Asterigerina lucida and Cibicides salensis" be characterizing by succession of three foraminiferal complexes. The first complex in the main consists of arenaceous foraminifera with dominating *Rhabdammina* sp., *Saccammina grzybowskii* Bogd., *S. variabilis* Bogd., *Reophax* sp., *Ammobaculites* sp., *Heterostomella* sp., *Haplophragmoides stavropolensis* Ter-Grig forma micra. Among calcareous foraminifera in the complex, *Cibicides* aff. *dutemplei* (Orb.), *Melonis* aff. *anulatum* (Chalil.) *striata* Chalil., *Baggatella* ? sp., *Uvigerina* ex gr. *tenuistriata* Nutt. (non Reuss), *Bolivina simplex simplex* Bal. are present. In general, A.P. Pechenkina characterized deposits with that association as beds with assemblage of mainly primitive agglutinated foraminifera *Rhabdammina*, *Saccammina* and others, single calcareous species (*Uvigerina*), numerous radiolaria, diatoms and spongue spicules.

After A.P. Pechenkina the second complex of "zone Asterigerina lucida and Cibicides salensis" is distinguished by various agglutinated foraminifera and abundant radiolarians, diatoms and spongue spicules. Among foraminifera the most numerous and characteristic are *Saccammina variabilis* Bogd., *Reophax* aff. *scalaria* Grzyb., *Ammodiscus granatus* Subb. (msc.), *Haplophragmoides stavropolensis* Ter-Grig., *Ammobaculites* sp., *Trochammina parva* Cushm. et Laim., *Tr.* sp., *Trochamminoides* sp., *Spiroplectammina praecarinata* J. Nik. *vislovensis* J. Nik. Sometimes single calcareous species *Melonis* ex gr. *dozularensis* (Chalil.), *Cibicides* ex gr. *borislavensis* Ais. are found.

The third complex of "zone with Asterigerina lucida and Cibicides salensis" consists of calcareous foraminifera *Rotalia* sp., *Asterigerina* aff. *ambiqua* Kraeva, *As. lucida* Minakova, *Melonis* ex gr. *dosularensis* (Chalil.), *Cibicides janchini* J. Nik., *C. sulzensis* (Hermm.), *C. extremus* Schutzk., *C.* aff. *macrurus* N. Byk., *Baggina iphigenia* (Sam.), *Nonion* aff. *granosus* (Orb.), *Bolivina ovataeformis* Chalil., *B.* aff. *aenariensiformis* Mjatl. and others, accompanying with single *Nummulites orbignyi* (Gall.). A.P. Pechenkina noted the more shallow-water character of the third complex.

It is necessary to note that A.P. Pechenkina considered “zone Asterigerina lucida and Cibicides salensis” to be of early Oligocene age and correlated it with the Khadum Horizon of the Northern Fore-Caucasus grounded on stratigraphic views of that period.

The same succession of foraminifera associations was described by Ye.Ya. Kraeva [46] in the Rojlanka borehole section in interval 472,4-351 m. Siltstones and silts (457-351 m) with mollusks and BF Ye.Ya. Kraeva correlated with the Khadum Horizon of Lower Oligocene. But later it was determined that deposits of the same interval include calcareous nannofossils of upper Eocene Zones NP 19/20 and NP 21 [56, 113].

N.G. Savenko [83, 100] considered “zone Asterigerina lucida and Cibicides salensis” Upper Eocene and determined its characteristic association consisting of *Haplophragmoides* ex gr. *rotundidorsatum* Hantk., *H. eggeri* Cushm., *H.* ex gr. *kiewensis* Kapt., *Spiroplectammina azovensis* J. Nik., *Marginulina behmi* (Reuss), *Asterigerina lucida* Minak., *Cibicides salensis* J. Nik. and others. Also she noted connections arenaceous foraminifera with layers of non-calcareous silt rocks.

Author’s notes. The described BF assemblage should be considered as assemblage-zone Eoeponidella lucida, Cibicidoides salensis as it was proposed by A.P. Pechenkina. Due to presence *Haplophragmoides stavropolensis* Ter-Grig., *Clavulinoides szaboi* (Hantk.), *Robulus calcariformis* Schwemb., *Frondicularia budensis* (Hantk.), *Cibicidoides sulzensis* (Herrm.), *Cib. extremus* Schutzk., *Melonis dozularensis* (Chalil.), *Eoeponidella lucida* (Minak.), *Baggina iphigenia* (Sam.), *Loxostomoides millepunctatus* (Tutkow.), *Globocassidulina globosa* (Hantk.) and others known from Upper Eocene interregional zone Planulina costata of the CCR [9] and its stratigraphic analogue in the other areas [66], the zone Eoeponidella lucida, Cibicidoides salensis of the southwestern part of the NPBSR should be considered to be of Priabonian age (see fig. 4).

Beds with arenaceous foraminifera. O.K. Kaptarenko-Chernousova, E.S. Lipnik [19] described from hole drilled near Chkalov village in the south-western part of the Near-Azov Region the assemblage with arenaceous foraminifera consisting of numerous *Rhabdammina cylindrica* Glaessn., *Psammosphaera fusca* Schultze., *Proteonina fusiformis* Will., *Pr. ampulacea* Brady, *Ammodiscus incertus* (Orb.), *Reophax scalaria* Grzyb., *R. plana* Halk., *Ammobaculites agglutinans* (Orb.), *Haplophragmoides kiewensis* Kapt., *H. rotundidorsatum* Hantk., *H.* sp., *Cyclammina cancellata* Brady, *Spiroplectammina carinata* (Orb.), *Textularia* sp., non-numerous and poor preserved calcareous speciments *Spiroloculina* sp., *Gyroidina soldanii* Orb., *Cibicides lobatulus* (Walk. et Jac.), *Anomalina* sp. They noted that clays including that BF assemblage overlay marls with foraminifera of “the Kiev Stage” and underlay siliceous clays with abundant radiolarians and spongue spicules, clayey aleurolite with numerous *Spiroplectammina carinata* (Orb.). Based on comprising the assemblage with arenaceous foraminifera with that of “the Kiev Stage” of the Dnieper-Donets Depression, O.K. Kaptarenko-Chernousova and E.S. Lipnik have corresponded the siliceous clays with arenaceous foraminifera of the Near-Azov Region to Lower Oligocene.

Ye.Ya. Kraeva [41, 44] has considered assemblage with arenaceous foraminifera as zone due to it stratigraphic position between beds with Upper Eocene foraminifera and Oligocene “zone with Spiroplectammina carinata”. She noted that this assemblage was reported by O.K. Kaptarenko-Chernousova and E.S. Lipnik [19] in the south-western part of the Near-Azov Region and A.P. Pechenkina [40] from borehole drilled near Mirnoe village the Odessa area (the southwestern part of the NPBSR). After Ye.Ya. Kraeva, zonal association consists of representatives of genera *Rhabdammina*, *Proteonina*, *Ammodiscus*, *Reophax*, *Ammobaculites*, *Haplophragmoides*, *Cyclammina*, *Spiroplectammina*, *Frankeina*. Later in her other publication [96] she concluded that assemblage with arenaceous foraminifera characterizes the Rubanovka Beds in the NPBSR.

A.P. Pechenkina, Ye.Ya. Kraeva [59] have examined distribution of arenaceous foraminifers association from the south-western part of the Near-Azov Region to the eastern part of the NPBSR. They have considered the assemblage of arenaceous foraminifera of the NPBSR as an analogue of “zone Haplophragmoides deformabilis” of the Stavropol Region [59, 73]. Researchers considered “zone of arenaceous foraminifers” as beds with mainly agglutinated foraminifera occur

between Upper Eocene deposists and that of "zone Spiroplectammina carinata". Zonal association includes *Saccammina variabilis* Bogd., *Saccammina* sp., *Reophax* sp., *Ammobaculites* sp., *Hyperammina* sp., *Haplophargmoides deformabilis* Subb., *Trochammina exposited* Ter-Grig. (msc.), *Ammomarginulina foliaceus* (Brady), *Textularia* sp., *Spiroplectammina azovensis* J. Nik., *Gaudryina gracilis* (Cushm. et Laim.), also calcareous species *Cibicides* ex gr. *sulzensis* (Hermm.), *C. pseudoungerianus* Cushm., *C. extremus* Schut., *Melonis dozularensis* Chalil., *Globulina gibba* Orb., *Pyrulina cylindroides* (Roem.).

From the end of sixties, the zone of arenaceous foraminifera was considered as stratigraphic analogue of "beds with *Lenticulina herrmanni*" of Lower Oligocene in the NPBSR [31, 42, 52, 56, 88, 93, 111]. Zonal BF complex includes agglutinated species *Saccammina variabilis* Bogd., *Rhabdammina* aff. *cylindrica* Glaessn., *Reophax* aff. *elongata* Grzyb., *Hyperammina* cf. *caucasica* Bogd., *Haplophragmoides stavropolensis* Ter-Grig., *H. deformabilis* Subb., *Ammomarginulina foliacea* (Brady), *Spiroplectammina azovensis* J. Nik., *Gaudryinopsis gracilis* (Cushm. et Laim.) and secreted ones *Lenticulina* ex gr. *herrmanni* (Andr.), *Cibicidoides extremus* (Schutzk.), *Cib. oligocenicus* (Sam.), *Melonis affine* (Reuss), *M. dozularensis* Chalil., *Brizalina mississippiensis* (Cushm.).

I.D. Konenkova [36] described beds with agglutinated foraminifera, numerous spongue spicules and radiolarians from Upper Eocene shallow-water deposits of depressions the southern part of US. The BF association includes species known from "zone of arenaceous foraminifera" of the Northern Near-Black Sea Region, namely *Reophax scalaria* Grzyb., *R. plana* Halk., *Ammodiscus incertus* Orb., *Haplophragmoides stavropolensis* Ter-Grig., *Ammobaculites agglutinans* (Orb.), *Trochammina* ex gr. *florata* Ter-Grig. and others.

Author's notes. The described BF assemblage should be regarded as assemblage-zone arenaceous foraminifera as it was proposed by Ye.Ya. Kraeva. Stratigraphic position of zone arenaceous foraminifera today remains still uncertain. In Stratigraphic Schemes of Paleogene deposits of the southern Ukraine [64, 67, 90, 91] the beds with arenaceous foraminifera correspond to the Lower Oligocene and occupy position stratigraphically below zone Spiroplectammina oligocenica. Presence such species as *Haplophragmoides deformabilis* Subb., *H. stavropolensis* Ter-Grig., *Spiroplectammina azovensis* J. Nik., *Gaudryinopsis gracilis* (Cushm. et Laim.), *Cibicidoides extremus* (Schutzk.), *Cib. oligocenicus* (Sam.), *Melonis dozularensis* (Chalil.), *Bolivina mississippiensis* (Cushm.) and others identifies the lowest Oligocene regional zones Haplophragmoides fidelis and Haplophragmoides deformabilis of the Stavropol Region (the Central Fore-Ciscaucasus) [9] or zone Cibicidoides salensis of the south-eastern outlying part of Russian Platform and the Skytian Plate after Yu.P. Nikitina [66]. New data on calcareous nannofossils from beds with arenaceous foraminifera of the NPBSR and its analogues in the Crimean Peninsula [3, 56, 94] and other stratigraphical materials [78, 81, 94] show corresponding zone arenaceous foraminifera to Upper Epocene (see fig. 4). But the possibility of trassitional Eocene-Oligocene stratigraphic position of the arenaceous foraminifera assemblage in some sections could not be excluded.

Beds with *Gaudryinopsis gracilis* and *Heterolepa almaensis*. I.D. Konenkova [30] from borehole drilled near Malaya Belozerka village (on the north of the eastern part of the NPBSR) described interesting BF assemblage consisting of arenaceous species known from "zone of arenaceous foraminifera" (*Ammodiscus tenuiculus* Subb., *Haplophragmoides deformabilis* Subb., *H. stavropolensis* Ter-Grig., *Spiroplectammina vicina* (Erem.), *Gaudryinopsis grasilis* (Cushm. et Laim.), *Verneuilina rasilis* Subb.) and calcareous ones distributed in upper Eocene – lower Oligocene (*Guttulina problema* Orb., *Anomalina munda* (N. Byk.), *An. munda assakensis* Korov., *Heterolepa almaensis* (Sam.), *Cibicidoides oligocenicus* (Sam.), *Melonis dozularensis* (Chalil.), *Baggina iphigenia* (Sam.), *Caucasina schischkinskyae* (Sam.), etc.). She named the assemblage as "zone Gaydryina gracilis and Heterolepa almaensis" and coresponded it to lower Oligocene. This assemblage also includes *Reophax scalaria* Cz., *Saccammina variabilis* Bogd., *Trochammina florifera* Subb., *Ammomarginulina foliacea* (Brady), *Subtilina* aff. *fidelis* (Ter-Grig.), *Pyrulina fusiformis* (Roem.), *Glandulina laevigata* (Orb.), *Asterigerina perbona*

Konen., *A. jucunda* Konen., *A. jucunda iniqua* Konen., *Pararotalia canui* Bhatia, *Bolivina compta carinata* Chalil.

Similar BF association in other researchers' publications of previous years were presented as "beds with *Heterolepa almaensis*" or "analogue of beds with *Lenticulina herrmanni*" [88, 93], as "zone with agglutinated foraminifera" [59] and "beds with mixed complex of foraminifers" and "beds with Trifarina transcaspiensis" [31].

Author's notes. Taxonomic composition of BF of zone Gaudryinopsis gracilis and Heterolepa almaensis is close to zone Cibicidoides salensis of the south-eastern outlying part of the Russian Platform and the Skythian Plate [66]. Yu.P. Nikitina considered zone Cibicidoides salensis to be of early Oligocene age. But according to publication [94] deposits of zone Cibicidoides salensis contain calcareous nannofossils of Zone NP 20 and, thus, should be dated the Priabonian. Thus, based on correlation with zone Cibicidoides salensis, zone Gaudryinopsis gracilis and Heterolepa almaensis of the NPBSR should be compared with the Upper Eocene (see fig. 4).

Beds with *Angulogerina transcaspiensis*. Ye.Ya. Kraeva [54] has described BF "complex with *Trifarina transcaspiensis*" from the lower part of mainly non calcareous sands, silts and clays of the south the eastern part of the Near-Azov Region. These deposits she considered as Lower Oligocene. Except index-species *Trifarina transcaspiensis* (Moroz.) this assemblage includes *Hyperammina* sp., *Saccammina* ex gr. *ampullacea* (Brady), *Ammobaculites foliaceus* (Brady), *Textularia tuaevi* (Moroz.), *Gavelinella* ex gr. *munda* N. Byk., *Caucasina schischkinskya*e (Sam.), *C. adziderensis* Chalil., *Caucasina* sp., *Bolivina mississippiensis* Cushm., *Seabrookia* sp. After Ye.Ya. Kraeva, the beds with *Angulogerina transcaspiensis* occur below the beds with *Lenticulina herrmanni* and arenaceous foraminifera in the Lower Oligocene section of that region.

I.D. Konenkova [31] gave more accurate definition the stratigraphic position of the beds with *Angulogerina transcaspiensis*. After her these beds occur between the layers containing impoverished BF association of upper part of Upper Eocene zone Bolivina antegressa and the beds with mixed BF assemblage (an analogue of zone Eoeponidella lucida and Cibicidoides salensis and zone arenaceous foraminifera in the article). I.D. Konenkova suplemented the species composition of the beds with *Angulogerina transcaspiensis* with *Reophax plana* Halk., *R. nodulosus* (Brady), *R. scalaria* Grzyb., *Saccammina fusiformis (*Will.), *Rhizammina indivisa* Brady, *Trochammina advena* Cushm., *Haplophragmoides stavropolensis* Ter-Grig.*, *Spiroplectammina vicina* Erem., *Martinoitella* ex gr. *communis* (Orb.), *Frondicularia budensis* (Hantk.)*, *Alabamina almaensis* (Sam.)*, *Baggina iphigenia* (Sam.)*, *Cibicidoides* aff. *pseudoungerianus* (Cushm.)*, *Cib. tahtaensis* (Schutzk.)*.

BF of the beds with *Ang. transcaspiensis* of the eastern part of the Near-Azov Region contain species (marked by (*) in the list) known from Upper Eocene zone Marginulinopsis infracompressus, zone Asterigerina, Nonion, Bolivina, zone Eoeponidella lucida and Cibicidoides salensis of the NPBSR. The species *Spiroplectammina tuaevi* Moroz., *Sp. vicina* Erem., *Brotzenella munda* (N. Byk.), *Caucasina schischkinskyae* (Sam.), *Bolivina mississippiensis* Cushm. are known from zone Cibicidoides salensis of the Sal-Manych-river interflue [9, 66]. But, because of definition calcareous nannofossils of zone NP 20 [94], deposits of zone Cibicidoides salensis should be consider the Priabonian.

Common BF species of beds with *Ang. transcaspiensis* of the eastern part of the ACM and zone Gaudryinopsis gracilis and Heterolepa almaensis of the north of eastern part of the NPBSR [30] are *Reophax scalaria* Grzyb., *Ammomarginulina foliacea* (Br.), *Haplophragmoides stavropolensis* Ter-Grig., *Baggina iphigenia* (Sam.), *Brotzenella munda* (N. Byk.), *Caucasina schischkinskyae* (Sam.).

Author's notes. Taxonomic composition of BF the beds with *Angulogerina transcaspiensis* of the eastern part of the ACM is close to Upper Eocene zone Asterigerina, Nonion, Bolivina, zone Eoeponidella lucida and Cibicidoides salensis, zone Gaudryinopsis gracilis and Heterolepa almaensis of the eastern part of the NPBSR and zone Cibicodoides salensis of the Sal-Manych-river interflue. Thus, on my opinion, the beds with *Angulogerina transcaspiensis* should be compared with the Priabonian (see fig. 4).

Beds with Anomalinacea, Miliolidae, *Asterigerina*, *Pararotalia.* Due to investigations of I.D. Konenkova [36] and N.G. Savenko, it was determined that "beds with *Marginulina infracompressa*" in depression the southern part of US are replaced by shallow-water BF association consisting of numerous and various Anomalinacea and Cibicididae, prevalence Rotaliacea, namely *Anomalina granosa* (Hantk.), *An. affinis* (Hantk.), *An.* ex gr. *grosserugosa* (Hantk.), *Heterolepa eocaena* (Guemb.), *H. pygmeus* (Hantk.), *Cibicides carinatus* (Terq.), *C. orbicularis* (Terq.), *C. lobatulus* (Walker et Jac.), Miliolidae, namely *Quiqueloculina soljenica* Jartz., *Q. circularis* Born., *Q. seminulum* (Linne), *Q. austriaca* (Orb.), *Spiroloculina costifera* Terq., *Triloculina trigonula* (Lam.), *Nodobaculariella contracta* (Terq.), *N. jartzevae* (Bogd.), frequent *Eponides stellatus* Kraeva, *Discorbis orbicularis* Terq., *Asterigerina stelligera* Kraeva, *As. rotula* Kaufm., *Melonis umbilicatulus* (Montf.), *Pararoralia lithothamnica orientalis* (Cushm. et Berm.), *P. praecalcar* (Mjatl.), *Elphidium latidorsatum* (Reuss), *Cycloloculina annulata* Heron-Allen et Earl., *Conobrina latdorfiensis* Jiess. et Lotsch., *Reussella spinulosa* (Reuss), *Robertina germanica* Cushm. et Park., others. According to I.D. Konenkova this BF association is very similar with that of Upper Eocene the Mandrykovka beds of the US. Priabonian age of the beds with Anomalinacea, Miliolidae, *Asterigerina*, *Pararotalia* is proved by distinguishing calcareous nannofossils of Priabonian zone NP 19 [36].

Author's notes. Beds with Anomalinacea, Miliolidae, *Asterigerina*, *Pararotalia* characterize shallow-water peripheral facies of the southern Ukraine Eocene basin on the southern slope of US in Priabonian time (see fig. 4).

Oligocene. Up to the beginning of the fifties years of XX century in the NPBSR section only two BF assemblages were known as Oligocene. The first, lower, is "horizon with arenaceous foraminifera" now considering late Eocene age (see above). The second, upper, BF association is "horizon with numerous *Spiroplectammina carinata*". Later Ye.Ya. Kraeva identified "complex with *Sphaeroidina*" from middle Oligocene deposits of the region.

Today the following biostratigraphic units by BF are distinguished in Oligocene section of the NPBSR and adjacent part of the southern slope of US: zone Spiroplectammina oligocenica (lower Rupelian, the Planorbellian Regiostage); zone Sphaeroidina variabilis (Chattian, the Kerleutian Regiostage, Askania Horizon) and zone Elphidium onerosum, Cibicidoides ornatus (Chattian, the Kerleutian Regiostage, Gornostaevka Horizon).

Planorbellian Regional Stage. Zone Spiroplectammina oligocenica. In literature on Paleogene stratigraphy of the southern part of platformian Ukraine "horizon with *Spiroplectammina* sp." firstly was reported from upper part of "the Kharkov Stage" in borehole drilled near Stepanovka village (the southwestern part of the Near-Azov Region) in publication [20]. After V.F. Kosireva, the distinguishing species of that horizon are *Ammobaculites* sp., *Haplophragmoides* aff. *periferoexcavatus* Subb. She compared "horizon with *Spiroplectammina* sp." with middle Oligocene "subhorizon with *Spiroplectammina* sp." of the Alma section of Crimean Peninsula (after P.B. Samoilova) and with "beds with *Spiroplectammina* sp." of Paleogene deposits the Nikopol area (after M.V. Yartseva, msc., 1949).

O.K. Kaptarenko-Chernousova and E.S. Lipnik [19] described "horizon with numerous *Spiroplectammina carinata* (d'Orb.)" in Oligocene section of borehole drilled near Chkalov village (the south of the Molochnaya river basin). Researchers also designated characteristic species for the horizon. There are *Cibicides pseudoungerianus* Cushm., *C. lobatulus* (Park et Jon.), *Gyroidina soldanii* (Orb.), *Pullenia sphaeroides* (Orb.), *Bulimina advena* Cushm., *Uvigerina asperula* Cz., deformed *Nonion umbilicatulus* (Mont.).

Ye.Ya. Kraeva [41, 42, 44] determined the assemblage with *Spiroplectammina* as "zone with Spiroplectammina carinata" of the Lower Oligocene in the Tokmak-Melitopol and the Near Sivash areas. As the most representative and abundant species of this zone she marked *Spiroplectammina carinata* (Orb.), *Caucasina schischkinskajae* (Sam.), *Bolivina mississippiensis* Cushm. Less numerous species in the complex are *Cibicides oligocenicus* (Sam.), *C. pseudoungerianus* Cushm., *Neogyroidina memoranda* Subb., *Uvigerinella majcopica* Kraeva [41, 43, 44, 59, 96]. Among other characteristic species of the assemblage she indicated *Ammodiscus incertus* (Orb.), *Cyclammina cancellata* Brady, *C.* ex gr. *constictimargo* K. E. Stew.,

Miliolina sp., *Globulina gibba* Orb., *Nonion* sp., *Pullenia bulloides* (Orb.), *Gyroidina soldanii* (Orb.), *Uvigerina* ex gr. *asperula* Cz., *Angulogerina* ex gr. *wilcoxensis* (Cushm. et Pont.).

At the same time M.V. Yartseva [107] described BF distribution in manganese-ore bed, underlying and overlying it beds of the Nikopol manganese-ore basin. From silts and clays withing calcareous manganese-ore bed M.V. Yartseva distinguished BF "complex with *Caucasina schischkinskyae*" regarded by her as an analogue of "horizon with *Spiroplectammina*" of the Crimea. She indicated [71] *Spiroplectammina carinata* (Orb.), *Sp.* ex gr. *mayerina* Orb., *Miliolina* ex gr. *akneriana* Orb., *Entosolenia marginata* (Walk. et Jac.), *Nonion granosum* Orb., *Asterigerina* aff. *bracteata* Cushm., *Gyroidina memoranda* Subb., *Valvulineria iphigenia* Sam., *Cibicides praecursorius* (Schwag.), *C. pseudoungerianus* Cushm., *C. lobatulus* (Walk. et Jac.), *Rotalia* ex gr. *calcar* Orb., *Caucasina schischkinkyae* (Sam.), *Angulogerina oligocaenica* Andr., *Bolivina beyrichi* Reuss, *B. mississippiensis* Cushm., *B. microlancetiformis* Subb., *B.* ex gr. *elongata* Orb., *B.* aff. *advena* Cushm., *Cassidulina laevigata* Orb. On my opinion presence Miliolidae, *Asterigerina*, Rotaliidae, *Cibicidoides lobatulus* (Walk. et Jac.) indicates more shallow-water conditions of sedimentation in comparison with those in the NPBSR.

From clays of the lower part of over-ore strata in the Bolshoy-Tokmak manganese-ore deposit M.V. Yartseva [86, 87] defined *Spiroplectammina carinata* (Orb.), *Miliolina circularis* Born., *Cibicides oligocenicus* Sam., *C. pseudoungerianus* Cushm., *Gyroidina memoranda* Subb., *Nonion granosus* (Orb.), *Pullenia bulloides* Orb., *Bolivina* cf. *beyrichi* Andr., *B. mississippiensis* Cushm., *Uvigerinella majcopica* Kraeva, *Angulogerina pulchella* Cushm. et Edw., *Ang.* ex gr. *oligocenica* Andr., *Caucasina schischkinskajae* (Sam.), others.

Due to Ye.Ya. Kraeva, I.D. Konenkova, N.G. Savenko, Yu.P. Nikitina, A.P. Pechenkina and M.V. Yartseva's investigations [22, 30-32, 35, 36, 54, 59, 68-71, 73, 87, 88, 99, 107], characteristic features of BF association of zone Spiroplectammina carinata widely dirstributing in Lower Oligocene deposits of the NPBSR, the southern slope of US and adjacent part of the ACM have been diagnosed. Zone Spiroplectammina oligocenica are distinguished in the section by appearance numerous index-species. Zonal BF association is stable and includes [52, 93] *Spiroplectammina azovensis* J. Nik., *Cyclammina* cf. *constrictimargo* (R. E. et K. C. Stew.), *Quinqueloculina* aff. *errmanni* Born., *Robulus simplicissimus* Reuss, *Melonis praevis stavropolicus* Bogd., *M. dozularensis* (Chalil.), *Pullenia bulloides* (Orb.), *Neogyroidina memoranda* Subb., *Pseudoparella caucasica* Bogd., *Cibicidoides speciosus* (Cushm. et Sed.), *Cib. expertus* (Schutzk. et Ter-Grig.), *Cib. pseudoungerianus* (Cushm.), *Cib. oligocenicus* (Sam.), *Uvigerinella* ex gr. *californica* Cushm., *Baggina iphigenia* (Sam.), *Caucasina schischkinskayae* (Sam.), *Bolivina beyrichi* Reuss, *B.* ex gr. *mississippiensis* Cushm., *Uvigerinella majcopica* Kraeva, *Fursenkoina schreibersiana* (Rzeh.), *Angulogerina oligocenica* Andr., *An. gracilis* Cushm. et Laim., etc.

Author's notes. Zone Spiroplectammina oligocenica includes characterizing species of lower Rupelian interregional zone Spiroplectammina oligocenica of the Eastern Paratethys [9], namely *Spiroplectammina oligocenica* J. Nik., *Neogyroidina memoranda* (Subb.), *Uvigerinella majcopica* Kraeva, *Bolivina mississippiensis* Cushm., etc. In the Stratigraphic Scheme of the Southern Ukraine [64] the described BF assemblage is presented as regional zone Spiroplectammina oligocenica marking Upper Planorbellian Regional Substage of Lower Oligocene in the region (fig. 5). In the southern Ukraine the deposits with that BF association correspond to Rupelian calcareous nannofossils Zone NP 22 [3, 36, 56, 68, 69] and dinocyst zones Phthanoperidinium amoenum/Wetzeliella symmetrica and Wetzeliella gochtii [1, 2].

Kerleutian Regional Stage. Zone Sphaeroidina variabilis. Ye.Ya. Kraeva [41, 42] was the first who distinguished in Oligocene section of the Odessa-Kherson area "zone Sphaeroidina" represented by numerous shells *Spiroplectammina carinata* Orb. *follis* Kraeva, *Nonion umbilicatulus* (Montf.), *Cibicides* aff. *pseudoungerianus* Cushm., *C. oligocenicus* Sam., *Uvigerinella majcopica* Kraeva, *Sphaeroidina variabilis* Reuss. She also noted that this assemblage's pecularity is presence *Miliolina* aff. *brauni* (Reuss), *M. cognata* (Born.), *M.* ex gr. *circularis* (Born.). Ye.Ya. Kraeva also considered "zone Sphaeroidina" to be younger than "zone with Spiroplectammina carinata".

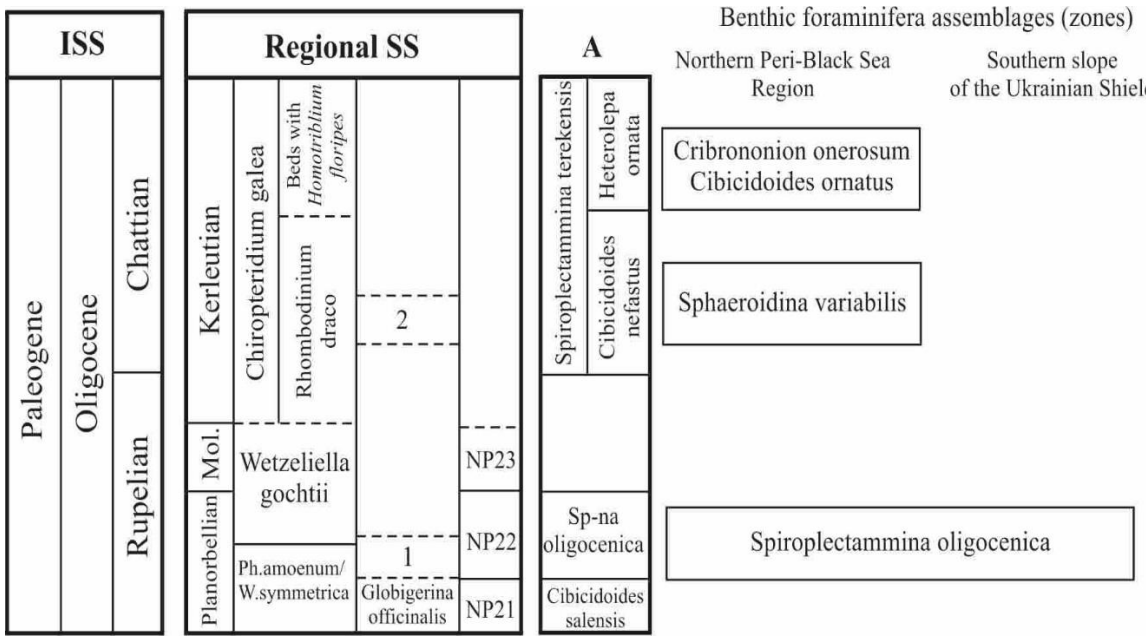

Fig. 5. Sequence of small benthic foraminifera assemblages in Oligocene of the northern Peri-Black Sea Region

A - interregional benthic foraminifera zones of the Eastern Paratethys and regional zones of the Sal-Manych-river interflue [9]; 1 - planktic foraminifera association with *Globigerina officinalis*, *Gl. ciperoensis*, *Gl. ouachitaensis*; 2 - planktic foraminifera association with *Globigerina senilis*, *Gl. praebulloides*, *Gl. ciperoensis*

In following years Ye.Ya. Kraeva [43, 44, 46, 61, 98, 99, 111] and N.G. Savenko [70, 84] studied BF taxonomic composition of the zone, their distribution in Oligocene deposits of the NPBSR. Researchers defined that “zone Sphaeroidina variabilis” determines lower part of the Askania Suite of southern Ukraine. N.G. Savenko [70] considered the zone as an age analogue of “beds with *Haplophragmoides kjurendagensis*” of the upper Kerleut deposits of the Crimean Peninsula.

According to Ye.Ya. Kraeva and N.G. Savenko [51, 95], the common list of foraminifera of “zone Sphaeroidina variabilis” the southern Ukraine includes numerous *Haplophragmoides kjurendagensis* Moroz., *Spiroplectammina terekensis* Bogd. (= *carinata follis* Kraeva), *Cibicidoides* aff. *aknerianus* (Orb.) (= *nefastus* J. Nik.), *Cib. majcopicus* (J. Nik.), *Uvigerinella majcopica* Kraeva, *Fursenkoina schreibersiana* (Cz.), *Sphaeroidina variabilis* Reuss, non-numerous *Saccammina grzybowskii* Bogd., *Hyperammina* sp., *Ammodiscus tenuiculus* Subb., *Haplophragmoides kjurendagensis kerleuticus* Kosir, *Haplophragmoides* sp., *Ammomarginulina foliaceus* Brady, *Spiroplectammina caucasica* Djan., *Quinqueloculina errmanni* Born., *Q. akneriana* Orb. var., *Saracenaria* aff. *vaginalis* (Reuss), *Lenticulina navis* (Born.), *L. eximia* Reuss, *Nodosaria calomorpha* Reuss, *Fissurina laevigata* Reuss, *Pyrulina fusiformis* (Roem.), *Guttulina problema* Orb., *Globulina gibba* Orb., *Cibicidoides pseudoungerianus* (Cush.), *Cib. oligocenicus* Sam., *Cib. stavropolensis* (Bogd.), *Cib. ornatus* (Bogd.), *Pullenia bulloides* (Orb.), *Melonis umbilicatulus* (Montf.), *M. dozularensis* (Chalil.), *Nonion granosus* (Orb.), *Neogyroidina memoranda* Subb., *Pseudoparella caucasica* Bogd., *Ammonia proprinqua* (Reuss), *Cribrononion onerosum* (Bogd.), *Porosononion dendridicus* Bogd., *Caucasina schischkinskyae* Sam., *C. buliminoides* Bogd., *Uvigerinella californica* Cushm., *Uv. californica parva* Kleinp., *Bolivina mississippiensis* Cushm., *Cassidulina subglobosa* Brady, *Sphaeroidina austriaca* Orb., *Robertina declivis* Reuss.

Analyzing taxonomic composition of the zone, Ye.Ya. Kraeva [51] concluded genera congeniality (similarity) and a significant number of common species of zones Sphaeroidina

variabilis and Spiroplectammina oligocenica. Also she denoted non numerous number of species known from Chattian foraminifera assemblages of the Western Europe.

Author's notes. In the NPBSR the zone Sphaeroidina variabilis characterizes the lower part of Askania Suite (Lower Kerleutian Regional Substage) (see fig. 5). Deposits of this zone contain dinocyst association of zone Chiropteridium galea [1, 2] and Upper Oligocene planktic foraminifera complex [1, 60, 79]. Due to presence of *Spiroplectammina terekensis* Bogd., *Cibicidoides nefastus* (J. Nik.), *Pseudoparella caucasica* Bogd., *Caucasina buliminoides* Bogd., *Uvigerinella californica* Cushm., *Sphaeroidina variabilis* Reuss and others, zone Sphaeroidina variabilis of the NPBSR corresponds to Chattian zone Spiroplectammina terekensis of the Northern Fore-Caucasus [9] and Upper Oligocene zone Cibicidoides nefastus of the Sal-Manych-river interfluve and Ergeny [66].

Zone Cribrononion onerosum, Cibicidoides ornatus. Ye.Ya. Kraeva [61] has indentified "nonionina complex" in silts and silty clays overlaying beds with *Sphaeroidina* in borehole 1 drilled near Svobodnyi Port village on the interfluve of the Dnieper and Southern Bug rivers. The assemblage consists of *Quinqueloculina* aff. *selenae* (Karrer), *Cibicides ornatus* Bogd., *Nonion dendridicum* Chalil., *N. granulosum* (Orb.), *Elphidium onerosum* Bogd. Ye.Ya. Kraeva named the found association after dominated BF group and regarded it to be of early Miocene age conditionally.

Due to further investigations of Ye.Ya. Kraeva and N.G. Savenko [51, 52, 84, 93, 98], taxonomic composition of the "nonionida complex" was determined and variability of its associations in different regions of the southern Ukraine was described.

Ye.Ya. Kraeva [91] renamed "nonionida complex" as "lone Porosononion dendridicus and Elphidium onerosum". She determined this zone as including in the main endemic foraminifera. Also she marked that besides index-species the most characteristic is *Cibicidoides ornatus* (Bogd.).

Common species list of "nonionida complex" of the southern Ukraine includes *Hyperammina* sp., *Sacammina* sp., *Quinqueloculina* ex gr. *ermani* Born., *Q.* ex gr. *pseudoseminula* Bogd., frequent *Q.* aff. *selenae* (Karrer), *Q.* ex gr. *circularis* (Born.), numerous *Globulina gibba* Orb., *Glandulina* sp., *Guttulina* sp., numerous *Pseudoparella caucasica* Bogd., numerous *Cibicidoides ornatus* (Bogd.), *Pullenia* sp., *Porozononion dendridicu*s (Chalil.), *Nonion granulosum* (Orb.), numerous *Nonion granosus* (Orb.), frequent *Melonis dozularensis* (Chalil.), *Ammonia* ex gr. *propinqua* (Reuss), *Cribrononion onerosum* (Bogd.), *Fursenkoina* ex gr. *schreibersiana* (Cz.), *Uvigerinella californica* Cushm. [95]. Association consisting of *Glandulina*, *Pseudoparella*, *Cibicidoides* and *Nonion*, prevalents in the NPBSR. In central part of the Peri-Black Sea Depression the assemblage is supplemented by *Quinqueloculina*, *Fursenkoina*, *Melonis* and *Uvigerinella*.

Ye.Ya. Kraeva [51] emphasized that in section of the south of former Soviet Union the "nonionida complex" occupies the same stratigraphic position, overlaying the beds with *Haplophragmoides kjurendagensis*, *Sphaeroidina variabilis*, *Cibicidoides nefastus* and underlaying the beds with *Neobulimina elongata*.

Author's notes. In the NPBSR the zone Cribrononion onerosum and Cibicidoides ornatus characterizes the Gornostaevka Suite which containing late Chattian dinocysts assemblage of beds with *Homotriblium floripes* of zone Chiropteridium galea [1] (see fig. 5). BF assemblage of zone Cribrononion onerosum and Cibicidoides ornatus of the NPBSR is similar to that of Upper Oligocene zone Cibicidoides ornatus of the Sal-Manych-river interfluve and Ergeny [66] due to common species *Pseudoparella caucasica* Bogd., *Cibicidoides ornatus* (Bogd.), *Nonion granosus* (Orb.), *Porozononion dendridicus* (Chalil.), *Nonion granulosum* (Orb.), *Melonis dozularensis* (Chalil.), *Ammonia* ex gr. *propinqua* (Reuss), *Cribrononion onerosum* (Bogd.), *Fursenkoina* ex gr. *schreibersiana* (Cz.), *Uvigerinella californica* Cushm.

Conclusions. Most of known small BF assemblages of Paleogene deposits of the NPBSR and adjacent parts of the US and ACM had been identified up to beginning the seventies of the last century due to M.V. Jartsteva, V.F. Kosireva, A.M. Voloshina, O.K. Kaptarenko-Chernousova, E.S. Lipnik, A.P. Pechenkina, Ye.Ya. Kraeva, N.G. Savenko and I.D. Konenkova's investigations.

Up to the end of XX century the researchers had studied taxonomic composition of the BF assemblages, had described their distinctive features and had defined characterizing species, had studied spreading the BF associations in the region.

As it turned out, the BF assemblages of relatively deep-water marine deposits of south the NPBSR include characterizing species of interregional BF zones of the CCR [9, 39]. But the most of known BF associations relate to the shallow and peripheral facies of the Paleogene sea basin in the south of Ukraine.

As a result, for Paleogene deposits of the NPBSR and adjacent parts of the US and ACM the following sequence and space-time relationships of small BF assemblages could be determined.

Lower Belokamenskian Regional Substage:

- zone Anomalina danica and Cibicidoides commatus (I.D. Konenkova, 1972) [26] considering as stratigraphic analogue of interregional Danian zone Anomalina danica s.l. of the CCR.

Upper Belokamenskian Regional Substage:

- shallow-water beds with *Cibicidina bundensis* and *Nonion multisuturatum* (I.D. Konenkova, 1972) [26].

Kachian Regional Stage:

- zone Anomalina fera and Pulsiphonina prima (A.P. Pechenkina, 1953 [40]; amended I.D. Konenkova, 1968, 1972) [21, 26] and zone Bolivinopsis spectabilis (I.D. Konenkova, 1972) [26] considering as stratigraphic analogues of Thanetian interregional zone Karreriella zolkaensis of the CCR.

Bakhchisaraian Regional Stage:

- BF assemblages corresponding to lower Ypresian interregional zone Pseudogaudryina externa of the CCR.

Simferopolain Regional Stage:

- BF association of upper Ypresian – lower Lutetian superzone Pseudogaudryina pseudonavarroana of the CCR and its shallow-water analogue the zone Vaginulinopsis decorata, Asterigerina stelligera.

Novopavlovkian Regional Stage:

- zone Robulus kuberlinus, Uvigerina bykovae ucrainica (Ye.Ya. Kraeva, 1968) [97] considering as stratigraphic analogue of Lutetian interregional zone Uvigerina costellata of the CCR;
- zone Pararotalia armata, Cibicidoides ex gr. sassei (M.V. Yartseva, 1947 [104]; amended M.V. Yartseva, Ye.Ya. Kraeva, 1983 [108]) and beds with Miliolidae, *Epistomaria rimosa* (M.V. Yartseva, 1947 [104]; amended M.V.Yartseva, Ye.Ya. Kraeva, 1983 [108]) being shallow-water analogues of zone Robulus kuberlinus, Uvigerina bykovae ucrainica.

Almian Regional Stage:

- zone Marginulinopsis infracompressus (Ye.Ya. Kraeva, 1954) [41] coresponding to Priabonian interregional zone Planulina costata of the CCR;
- zone Asterigerina, Nonion, Bolivina (Ye.Ya. Kraeva, 1954) [41] and zone Eoeponidella lucida, Cibicidoides salensis (Ye.Ya. Kraeva, 1954 [41]; amended A.P. Pechenkina, 1964 [72]) considering as shallow-water stratigraphic analogues of Priabonian interregional zone Planulina costata of the CCR;
- zone Gaudryinopsis gracilis, Heterolepa almaensis (I.D. Konenkova, 1987) [30], zone arenaceous foraminifera (O.K. Kaptarenko-Chernousova, E.S. Lipnik, 1951 [19]; amended Ye.Ya. Kraeva, 1954 [41]) and beds with *Angulogerina trancaspiensis* (Ye.Ya. Kraeva, 1979) [54] correlating with zone Cibicidoides salensis of the south-eastern part of the Russian Platform and Skythian Plate, and zone Eoeponidella lucida, Cibicidoides salensis of the NPBSR;
- beds with Anomalinacea, Miliolidae, *Asterigerina, Pararotalia* (I.D. Konenkova, 1996) [36] regarding as shallow-water analogues of zone Marginulinopsis infracompressus of the NPBSR.

Upper Planorbellian Regional Substage:

- zone Spiroplectammina oligocenica (O.K. Kaptarenko-Chernousova, E.S. Lipnik, 1953 [19]; amended Ye.Ya. Kraeva, 1954 [41]) being stratigraphic equivalent of Rupelian interregional zone Spiroplectammina oligocenica of the Eastern Paratethys.

Upper Kerleutian Regional Substage:

- zone Sphaeroidina variabilis (Ye.Ya. Kraeva, 1954) [41] corresponding to Chattian zone Spiroplectammina terekensis of the Northern Fore-Caucasus and to zone Cibicidoides nefastus of the Sal-Manych-river interflue;
- zone Cribrononion onerosum, Cibicidoides ornatus (Ye.Ya. Kraeva, 1966) [61] similar to Chattian zone Cibicidoides ornatus of the Sal-Manych-river interflue.

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Т.С. Рябоконь

БІОСТРАТИГРАФІЯ ПАЛЕОГЕНУ ПІВДЕННОЇ УКРАЇНИ ЗА ДРІБНИМИ БЕНТОСНИМИ ФОРАМІНІФЕРАМИ: ІСТОРИЧНИЙ ОГЛЯД

У статті наведено історію біостратиграфії палеогенових відкладів Південної України за дрібними бентосними форамініферами. Висвітлено значення праць з вивчення форамініфер О.К. Каптаренко-Чорноусової, Г.М. Волошиної, М.В. Ярцевої, Є.Я. Краєвої, А.П. Печенкіної, Н.Г. Савенко та І.Д. Коненкової. Завдяки їхнім дослідженням визначено послідовність і простово-часові співвідношення палеогенових комплексів форамініфер у регіоні. Наведено порівняння комплексів палеогену Південної України з міжрегіональними зонами за бентосними форамініферами Кримсько-Кавказького регіону. Статтю супроводжено повним бібліографічним списком з біостратиграфії палеогену Північного Причорномор'я, південного схилу Українського щита за бентосними форамініферами.

На початку 70-х років XX століття дослідники виділили та описали комплекси форамініфер, характерні для підвідділів і регіональних підрозділів палеогену Південної України. Було визначено систематичний склад комплексів бентосних форамініфер, з'ясовано їхнє поширення в палеогеновому розрізі Північного Причорномор'я, південного схилу Українського щита та прилеглої частини Приазов'я. Для окремих комплексів форамініфер було доведено їхнє регіональне значення; інші виявилися важливими для характеристики та датування світ, товщ, пачок і верств місцевих стратиграфічних схем. Асоціації форамініфер стосовно глибоководних відкладів півдня Північного Причорномор'я містять види зональних комплексів міжрегіональних зон за бентосними форамініферами Кримсько-Кавказького регіону. Більшість із виділених комплексів бентосних форамініфер характерні для порівняно мілководних відкладів палеогенового басейну в Північному Причорномор'ї та його периферійних фацій у межах депресій південного схилу Українського щита. Визначені простового-часові співвідношення комплексів бентосних форамініфер для регіоярусів палеогенового розрізу Південної України.

Ключові слова: бентосні форамініфери, палеоген, біостратиграфія, Південна Україна.

Т.С. Рябоконь

БИОСТРАТИГРАФИЯ ПАЛЕОГЕНА ЮЖНОЙ УКРАИНЫ ПО МЕЛКИМ БЕНТОСНЫМ ФОРАМИНИФЕРАМ: ИСТОРИЧЕСКИЙ ОБЗОР

В статье изложена история биостратиграфии палеогеновых отложений Южной Украины по мелким бентосным фораминиферам. Показано значение работ по изучению фораминифер О.К. Каптаренко-Черноусовой, А.М. Волошиной, М.В. Ярцевой, Е.Я. Краевой, А.П. Печенкиной, Н.Г. Савенко и И.Д. Коненковой. Благодаря их исследованиям установлены последовательность и пространственно-временные соотношения палеогеновых комплексов фораминифер в регионе. Приведено сопоставление комплексов фораминифер палеогена Южной Украины с межрегиональными зонами по бентосным фораминиферам Крымско-Кавказского региона. Статья сопровождена полным библиографическим списком по биостратиграфии палеогена Южной Украины по мелким бентосным фораминиферам.

К началу 70-х годов прошлого столетия, благодаря исследованиям О.К. Каптаренко-Черноусовой, Е.С. Липник, В.Ф. Козыревой, А.М. Волошиной, М.В. Ярцевой, Е.Я. Краевой, А.П. Печенкиной, Ю.П. Никитиной, Н.Г. Савенко и И.Д. Коненковой, были выделены и описаны комплексы мелких бентосных фораминифер, характерные для региональных подразделений палеогена Южной Украины. Были изучены систематический состав ассоциаций бентосных фораминифер, прослежено их распространение в палеогеновом разрезе Северного Причерноморья и южного склона Украинского щита, прилегающей части Приазовья. Для некоторых из выделенных комплексов фораминифер было доказано их региональное значение; другие сообщества фораминифер оказались важными для характеристики и датирования свит, толщ, пачек и слоев местных стратиграфических схем. Ассоциации фораминифер относительно глубоководных палеогеновых отложений юга Северного Причерноморья содержат виды зональных комплексов межрегиональных зон по бентосным фораминиферам Крымско-Кавказского региона. Большинство из установленных комплексов бентосных фораминифер характерны для относительно мелководных осадков палеогенового бассейна в Северном Причерноморье и фаций его периферии в пределах депрессий южного склона Украинского щита. Определены пространственно-временные соотношения комплексов фораминифер для регионярусов палеогена в разрезе

Южной Украины. Нижний регионодъярус белокаменского регионяруса характеризует зона Anomalina danica, Cibicidoides commatus, которая коррелируется с межрегиональной зоной Anomalina danica s. l. Крымско-Кавказского региона; верхний регионодъярус – слои с *Cibicidina bundensis*, *Nonion multisuturatum.* Качинский регионярус – зона Anomalina fera, Pulsiphonina prima и зона Bolivinopsis spectabilis, которые сопоставляются с межрегиональной зоной Karreriella zolkaensis Крымско-Кавказского региона. Комплексы фораминифер бахчисарайского регионяруса в Северной Причерноморье отвечают стратиграфическому уровню межрегиональной зоны Pseudogaudryina externa Крымско-Кавказского региона. Симферопольский регионярус характеризует зона Vaginulinopsis decorata, Asterigerina stelligera, которая коррелируется с надзоной Pseudogaudryina pseudonavarroana Крымско-Кавказского региона. Новопавловский регионярус – зона Robulus kuberlinus, Uvigerina bykovae ucrainica, которая является стратиграфическим аналогом межрегиональной зоны Uvigerina costellata Крымско-Кавказского региона, и зона Pararotalia armata, Cibicidoides ex gr. sassei и слои с Miliolidae, *Epistomaria rimosa.* Альминский регионярус – зона Marginulinopsis infracompressus, которая соотвествует межрегиональной зоне Planulina costata Крымско-Кавказского региона; зона Asterigerina, Nonion, Bolivina и зона Eoeponidella lucida, Cibicidoides salensis, слои с Anomalinacea, Miliolidae, *Asterigerina, Pararotalia*. Зона Gaudryinopsis gracilis, Heterolepa almaensis, зона песчаных фораминифер и слои *Angulogerina trancaspiensis* коррелируются с зоной Cibicidoides salensis юго-западной окраины Русской платформы и Скифской плиты и полагаются стратиграфическими аналогами зоны Eoeponidella lucida, Cibicidoides salensis Северного Причерноморья. Верхний регионодъярус планорбеллового регионяруса характеризует региональная зона Spiroplectammina oligocenica. Верхний регионодъярус керлеутского регионяруса – зона Sphaeroidina variabilis, которая коррелируется с зоной Spiroplectammina terekensis Северного Предкавказья и зоной Cibicidoides nefastus Сало-Манычского междуречья; зона Cribrononion onerosum, Cibicidoides ornatus, которая сопоставлена зоной Cibicidoides ornatus Сало-Манычского междуречья.
Ключевые слова: бентосные фораминиферы, палеоген, биостратиграфия, Южная Украина.

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