Zbl. Geol. Paläont. Teil I	1996	H. 11/12	1339 – 1348	Stuttgart, April 1998

The distribution of rotaliids (Foraminifera) in the Cretaceous and Paleogene of the Yamal Peninsula

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With 4 figures in the text

MARINOV, V. A. (1998): The distribution of rotaliids (Foraminifera) in the Cretaceous and Paleogene of the Yamal Peninsula. - Zbl. Geol. Paläont. Teil I, 1996 (11/12): 1339-1348; Stuttgart.

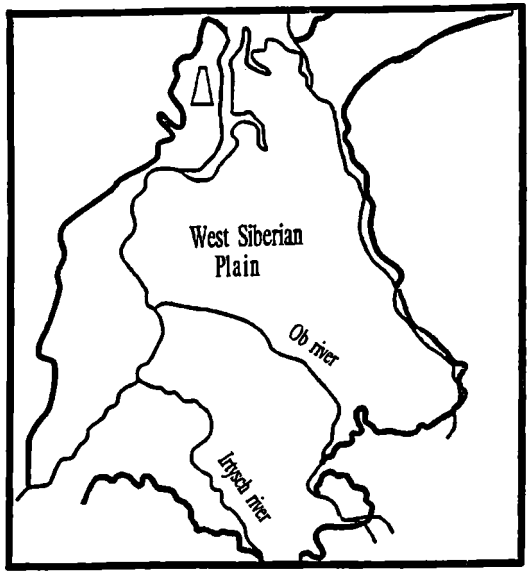
Abstract: Upper Cretaceous-Paleocene (Campanian-Thanetian) deposits in well sections of the Yamal Peninsula have been investigated. The replacement of taxa in the species groups of the order Rotaliida (Foraminifera) has been studied. The first and the last occurrences of particular species mark eight biohorizons. The succession of biohorizons allows the establishment of seven foraminiferal zones. Some of the biohorizons can be recognized in sections in the European palaeogeographic region, merely allowing the ages of these foraminiferal zones to be inferred. Two new species (*Cibicides praegankinoensis* and *Gemellides pseudoincognitus*) are described.

Zusammenfassung: Die Ablagerungen von Oberkreide und Paläogen wurden mit Hilfe von Bohrkernen von der Halbinsel Jamal untersucht. Die Aufeinanderfolge von Arten der Rotaliida (Foraminifera) wird beschrieben. Die Zeitpunkte des ersten (FAD) und letzten Erscheinens (LAD) der Arten markieren die acht Biohorizonte. Die Aufeinanderfolge der Faunenvergesellschaftungen erlaubt, sieben Foraminiferenzonen aufzustellen. Einige dieser Faunenvergesellschaftungen lassen sich in Profilen des europäischen paläogeographischen Gebiets wiederfinden und ermöglichen somit eine zeitliche Einordnung. Zwei neue Foraminiferenarten werden beschrieben.

1. Introduction

Microfaunal assemblages from the 220 m thick composite section of the Bovanenkovo nos. 1, 4 and 6 wells on the Yamal Peninsula have been studied (Fig. 1). The section ranges in age from the Campanian to Late Paleocene. It is composed of monotonous silty-clayey sediments. The section comprises, in ascending order: Beriosov Formation (clay); Gankin Formation (silty-clayey marl); Thalitsa Formation (silty clay). Some bi-

0340-5109/98/1996-1339 $ 2.50



1. 2.

Fig. 1. Location of studied well sections. 1: limits of Mesozoic-Paleogene deposits spreading on West Siberian plate; 2: wells.

valves and cephalopods have been found in the sections, but they cannot be accurately determined. The foraminiferal assemblages in the investigated sections consist of calcareous forms. This suggests a direct correlation between the Cretaceous-Paleocene boundary deposits of the Boreal-Arctic-West Siberian region and those of the Boreal-East-European region.

The benthic foraminifera constitute the most representative faunal group in the Cretaceous-Paleocene boundary deposits. Therefore the division of a section in West Siberia belonging to this interval is based on foraminifera (Decision ... 1991, PODOBINA 1975, 1989, GALERKINA et al. 1982). However, there were specific bottom environmental conditions during the Late Cretaceous in the West Siberian basin resulting from periodical decrease of the oxygen content. This phenomenon is responsible for the fact that assemblages of foraminifera with calcareous tests consistently alternated with assemblages of foraminifera with arenaceous tests. These alternations of environmentally controlled assemblages of benthic foraminifera in the section mask the evolutionary changes. The foraminiferal zonal scheme erected reflects an environmentally controlled of the alternation of the facial assemblages. New study of the development of selected foraminiferal groups, with particular reference to the sequence of taxa (first and last appearances) allow us to solve the problems of intra-basin and inter-basin correlations.

2. Material and methods

A total of 146 core samples from three well sections was collected. Samples (100 g weight) were immersed in water for about 24 h. They were washed over a 20-micron sieve. The larger fraction was dried and used for foraminiferal analysis. The number of specimens per sample ranged between 154 and 998. 123 taxa were identified to species level. The assemblages contain mostly calcareous benthic foraminifera, dominated by the order Rotaliida.

3. Results

Foraminifera of the order Rotaliida are ubiquitous in the section. Their percentage content in the foraminiferal assemblages is significant (from 60 to 90 %). The development of some species groups of this order has been investigated and the levels of evolutionary changes have been established. The most important genera for stratigraphical purposes are: *Cibicides* (*Cibicides* gr. *excavatus* BROTZEN), *Cibicidoides* (*Cibicidoides* gr. *eriksdalensis* BROTZEN), *Eponides* (*Eponides sibiricus* NECKAJA), *Anomalinoides* (*Anomalinoides pinguis* JENNINGS). Biohorizon recognition is based on the evolutionary changes in these genera. The biostratigraphically most important foraminifera species are shown in Fig. 2. The levels of the first (FO) and last (LO) occurrences of species allow the the establishment of eight biohorizons.

Biohorizon I. FO *Cibicidoides eriksdalensis primus* PODOBINA; LO *Cibicidoides eriksdalensis eriksdalensis* (BROTZEN) (Early - Late Campanian boundary).

Biohorizon II. FO *Anomalinoides pinguis pinguis* (JENNINGS) + *Cibicides globigeriniformis* NECKAJA + *Cibicides praegankinoensis* sp. nov.; LO *Anomalinoides pinguis neckajae* VASSILENKO + *Cibicides excovatus* BROTZEN, *Anomalinoides falsiplanctonicus* (BALAKHMATOVA) (intra-Late Campanian).

Biohorizon III. FO *Eponides sibiricus sibiricus* NECKAJA + *Angulogavelinella ahuvae* WEIDICH; LO *Eponides sibiricus praesibiricus* subsp. nov., *Anomalinoides pinguis pinguis* JENNINGS (a little later) (Campanian - Maastrichtian boundary).

Biohorizon IV. FO *Cibicides gankinoensis* NECKAJA + *Osangularia navarroana* (CUSHMAN) + *Cibicidoides spiropunctatus* GALLOWEY & MORROW, *Cibicidoides eriksdalensis pocurensis* KISSELMAN (a little earlier), *Brotzenella complanata* (REUSS) (a little later); LO *Cibicides globigeriniformis* NECKAJA + *Cibicides praegankinoensis* sp. nov. + *Angulogavelinella ahuvae* WEIDICH + *Eponides sibiricus sibiricus* NECKAJA.

Biohorizon V. FO *Heterolepa hemicompressa* (MOROZOVA) + *Gemellides pseudoincognitus* sp. nov. + *Cibicidoides occultus* (FREIMAN); LO *Cibicides gankinoensis* NECKAJA.

Biohorizon VI. LO *Osangularia navarroana* (CUSHMAN) + *Brotzenella complanata* (REUSS) (Maastrichtian - Danian boundary).

Biohorizon VII. FO *Cibicidoides favorabilis* VASSILENKO; LO *Cibicidoides occultus* (FREIMAN) (a little earlier) (probable Thanetian - Danian boundary.

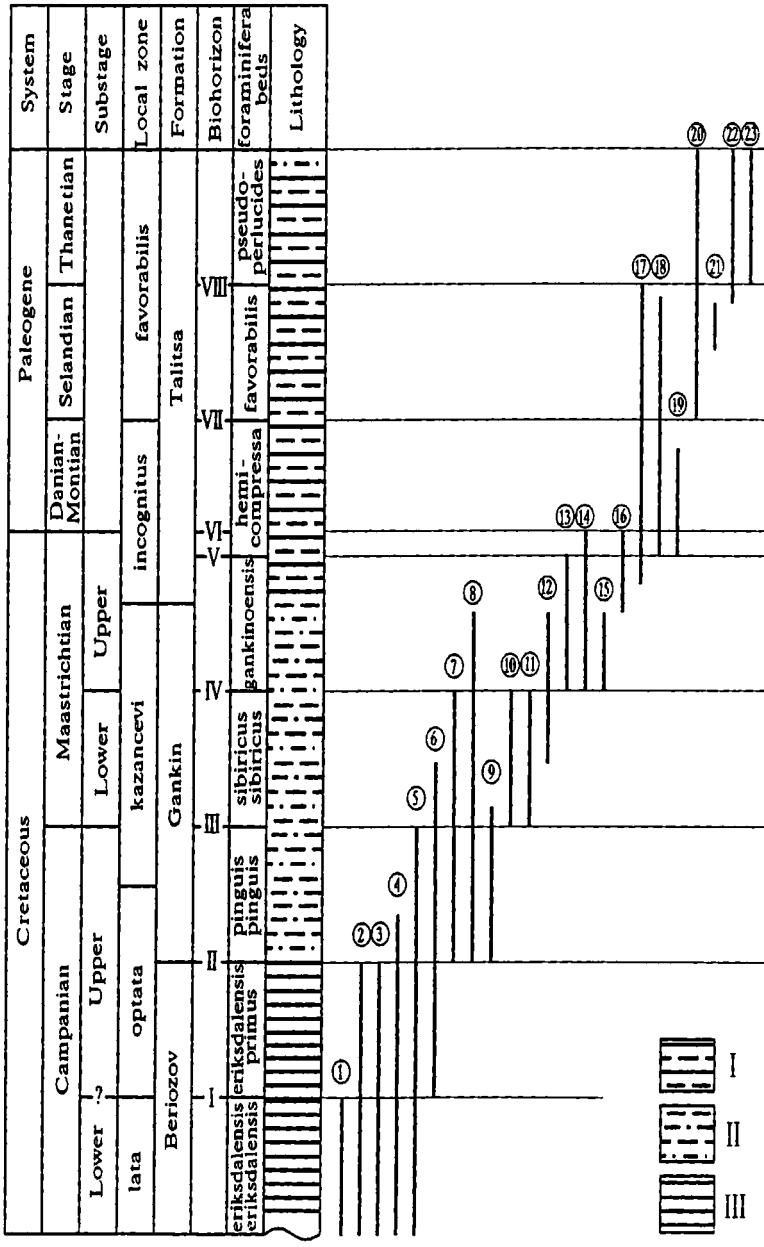


Fig. 2. Rotaliida species distribution chart and biozonation of the composite section of the Bovanenkovo no. 1 and no. 4 wells.
I - silty clay; II - silty-clayey marl; III - clay.
Legend for nos. 1 - 23 see next page.

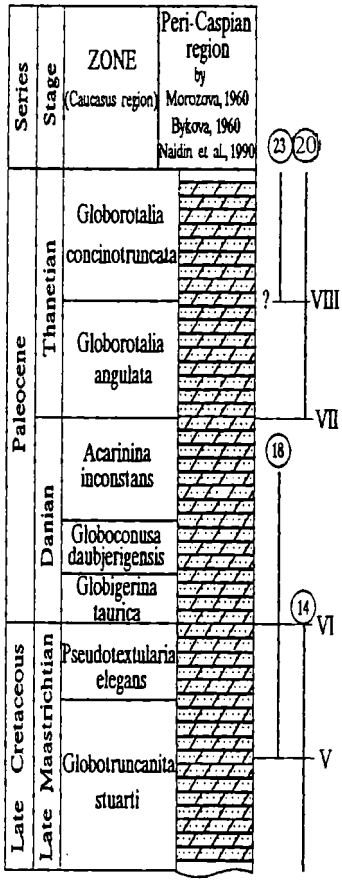


Fig. 3. Biohorizons IV, V, VI, VII, VIII in the Paleogene of the Peri-Caspian Region (based on MOROZOVA 1960, BYKOVA 1960, NAIDIN 1990).

Legend to Fig. 2:

1: *Cibicidoides eriksdalensis eriksdalensis* BROTZEN; 2: *Cibicides excavatus* BROTZEN; 3: *Anomalinoides pinguis neckajae* VASSILENKO; 4: *Anomalinoides falsiplanctonicus* (BALAKHMATOVA); 5: *Eponides sibiricus praesibiricus* subsp. nov.; 6: *Cibicidoides eriksdalensis primus* PODOBINA; 7: *Cibicides praegankinoensis* sp. nov.; 8: *Cibicides globigeriniformis* NECKAJA; 9: *Anomalinoides pinguis pinguis* JENNINGS; 10: *Angulogavelinella ahuvae* WEIDICH; 11: *Eponides sibiricus sibiricus* NECKAJA; 12: *Cibicidoides eriksdalensis pocurensis* KISSELMAN; 13: *Cibicides gankinoensis* NECKAJA; 14: *Osangularia navarroana* (CUSHMAN); 15: *Cibicidoides spiropunctatus* GALLOWEY & MORROW; 16: *Brotzenella complanata* (REUSS); 17: *Gemellides pseudoincognitus* sp. nov.; 18: *Heterolepa hemicompressa* (MOROZOVA); 19: *Cibicidoides occultus* (FREIMAN); 20: *Cibicidoides favorabilis* (VASSILENKO); 21: *Hanzawaja ekblomi* (BROTZEN); 22: *Gavelinella wellery* (PLUMMER); 23: *Gemellides pseudoperlucides* (BYKOVA).

Biohorizon VIII. FO *Gemellides pseudoperlucides* N. BYKOVA, *Gavelinella wellery* (PLUMMER) (a little earlier); LO *Heterolepa hemicompressa* (MOROZOVA) + *Cibicidoides pseudoincognitus* sp. nov. (probable boundary of *Globorotalia angulata* and *A. subsphaerica* zones).

The succession of biohorizons allows the establishment of seven foraminiferal zones in the investigated composite section in the interval 270-490 m. The ages of some biohorizons were interpreted on the basis of the correlation with the reference sections of the Peri-Caspian region (Fig. 3).

Biohorizons IV, V, VI are recognized on the Mangyshlak Peninsula. Biohorizon IV (FO *Cibicidoides spiropunctatus*) and Biohorizon V (FO *Heterolepa hemicompressa*) were established in the Aksyirtau and Sulukapy sections (NAIDIN et al. 1984), Kyzylsay and Koschak sections (NAIDIN et al. 1990), in the lower part of the *Globotruncanita stuarti* zone; Biohorizon VI (LO *Osangularia navarroana*) - at the top of the *Pseudotextularia elegans* zone in the Kyzylsay and Koschak sections.

Biohorizons VII, VIII are recognized in the Peri-Caspian Plain. Biohorizon VII (FO *Cibicidoides favorabilis*) is found at the base of the *Globorotalia angulata* zone (MOROZOVA 1960) and Biohorizon VIII (FO *Gemellides pseudoperlucides*) is established in the upper part of the *Globorotalia angulata* zone (BYKOVA 1960). The correlation of biohorizons with Peri-Caspian Plain deposits suggests the following tentative ages for the foraminiferal zones.

Zone I - *Cibicidoides eriksdalensis primus* (Late Campanian).
Zone II - *Anomalinoides pinguis pinguis* (Late Campanian).
Zone III - *Eponides sibiricus sibiricus* (Early Maastrichtian).
Zone IV - *Cibicides gankinoensis* (Late Maastrichtian).
Zone V - *Heterolepa hemicompressa* (Late Maastrichtian - Danian).
Zone VI - *Cibicidoides favorabilis* (Early Thanetian).
Zone VII - *Gemellides pseudoperlucides* (Thanetian).

This is a preliminary version of the stratigraphic scheme. Further investigation of the sequence of biohorizons would allow us to solve interregional correlation problems in detail.

4. Summary

1. Eight biohorizons have been established in the Upper Cretaceous-Paleocene (Campanian - Thanetian) section in wells in the Yamal Peninsula, West Siberian Basin. On the basis of the sequence of biohorizons, a biostratigraphical framework has been developed, which includes seven foraminiferal zones.
2. Biohorizons from IV to VIII have been traced in the East European Plain (Peri-Caspian) sections, which are dated by guide fossils. On the basis of correlation with these sections, tentative dating of the foraminiferal zones has been undertaken.

5. Systematic descriptions

Family ANOMALINIDAE CUSHMAN, 1928

Genus *Cibicides* MONFORT, 1808

Cibicides praegankinoensis sp. nov.

The holotype is housed in the collections of the Palaeontological Museum, Institute of Geology, Novosibirsk, n. -1075/1.

Type locality: West Siberian Plain, Yamal, Bovanenkovo no. 4 well, Gankin Formation, depth 386 m, sample 16.

Diagnosis: Test of medium size (0.3-0.5 mm), planoconvex, periphery lobulate and slightly angled. Spiral side coarsely perforate, evolute, almost plane, smooth umbilical side involute, somewhat conical, with deep and narrow umbilical area. Aperture low, continuing under narrow apertural lip on spiral side to periphery. Apertural area triangular, oblique on umbilical side. Seven, rarely eight, chambers in last whorl.

Comparison: The species differs from the morphologically identical species *Cibicides gankinoensis* NECKAJA (NECKAJA, 1948) in the chamber number in the last whorl (7-8 against 9) and evolute spiral side, and from the species *Heterolepa hemicompressa* MOROZOVA (1954) in the absence of an umbilical disk and the smooth umbilical side.

Dimensions (mm):

Test diameter (D)	0.37	0.38	0.34
Test thickness	0.20	0.19	-
Chamber number in last whorl	7	7	7

Age: Late Campanian - Early Maastrichtian.

Geographic distribution: West Siberian Plain, Gankin Formation.

Genus *Gemellides* VASSILENKO, 1954

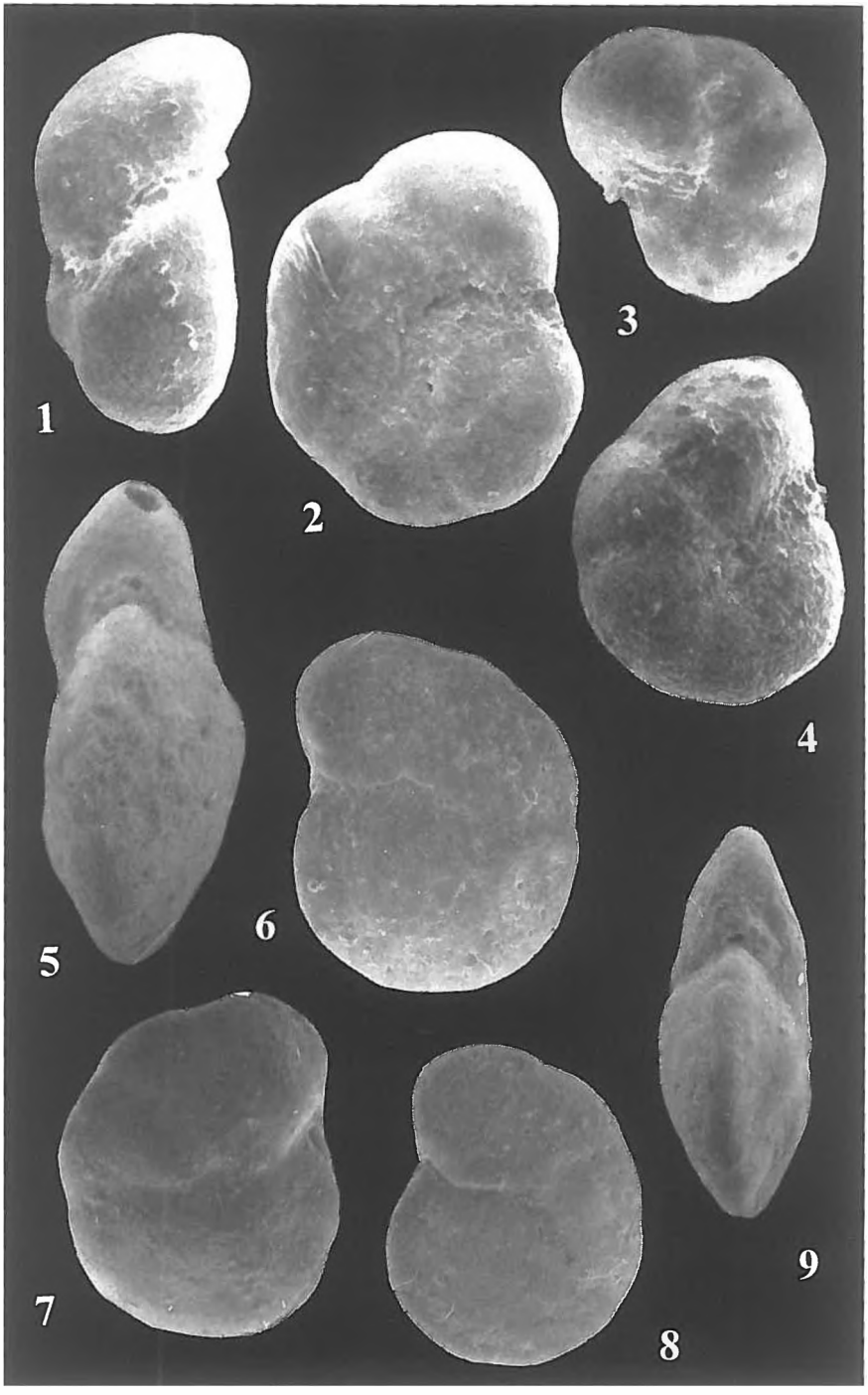
Gemellides pseudoincognitus sp. nov.

The holotype is housed in the collections of the Palaeontological Museum, Institute of Geology, Novosibirsk, n. -1075/6.

Type locality: West Siberia, Yamal, Bovanenkovo well no. 4, Talitsa Formation, depth 345 m, sample 21.

Diagnosis: Test small, biconvex, almost lenticular, a low trochospire, periphery angled. Spiral side coarsely perforate, evolute. Smooth umbilical side, involute. Aperture low, continuing under narrow apertural lip on periphery and ending on umbilical side. Aperture area triangular, slightly oblique on umbilical side.

Comparison: *Gemellides pseudoincognitus* sp. nov. differs from *G. pseudoperlucides* BYKOVA (1954) in the test shape (*G. pseudoperlucides* has a flat umbilical side, *G. pseudoincognitus* has a convex one), and from the species *Cibicidoides eriksdalensis pokurensis* KISSELMAN (1971) in the absence of an umbilicus, the evolute dorsal side, and in the continuation of the aperture position onto the umbilical side.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Dimensions (mm):

Test diameter (D)	0.30	0.29	0.28	0.25	0.20	0.18
Test thickness	0.13	0.13	0.13	0.11	0.11	0.09
Last chamber width	0.10	0.10	0.10	0.09	0.09	0.08
Chamber number in final whorl	9	9	9	9	7.5	7

Age: Late Maastrichtian - Early Paleocene.
Geographic distribution: West Siberian Plain, Talitsa Formation.

Acknowledgements. I am deeply grateful to the geologists of Nadym Geological Enterprise, V. G. GLADKOVSKII and O. V. KRASNOBAEV, for providing the borehole material and well log for the present study; to Dr. A. L. BEISEL for valuable critical comments on the manuscript.

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Fig. 4. New foraminifera species. 1-4: *Cibicides praegankinoensis* sp. nov., Bovanenkovo no. 4 well, depth 450 m, Gankin Formation; 5-9: *Gemellides pseudoincognitus* sp. nov., Bovanenkovo no. 4 well, depth 353 m, Taitsa Formation.

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