Biostratigraphy and foraminiferal Assemblages of the West Siberian Albian

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Abstract. New data of the Biostratigraphy and Albian foraminiferal assemblages from the sections of newly drilled wells in the Yamal peninsula have been obtained. This territory is assigned by the author to the Northern palaeobiogeographical district, the southern border of which goes along the latitudinal flow of the Ob River. The most diverse Albian foraminiferal assemblages have been discovered in the section of borehole 50 of the Malyginskaya area as well as in the sections of borehole 124 of the West-Tambeiskaya, boreholes, 201, 205 of the North-Tambeiskaya areas. Somewhat similar Albian foraminiferal assemblages were earlier studied by the author in 10 sections of the boreholes of the Samatlor area in the latitudinal Ob River Region. The Middle Albian assemblage is the most stable and diverse in its specific respect. It was discovered not only in the identified sections in the Yamal wells but also southwards in the earlier explored areas. The Albian foraminiferal species of the Yamal peninsula are illustrated in 5 photos and 1 drawing.

Key words. Biostratigraphy, Foraminifera, Albian, Western Siberia

1. Introduction
The Albian foraminiferal assemblages have been discovered recently in the Khanty-Mansiiskian Horizon in the Samatlor, Polarnaya, East-Lodochnaya and Southern Russkaya areas of Western Siberia [1]. Data on these assemblages were earlier obtained with regard to Transuralia [2]-[4]. The most detailed research with the description of many Albian species of Transuralia is presented by Z.I. Bulatova [2].

According to palaeobiogeographical division into districts within Western Siberia, these areas with the exception of Transuralia are related to the Northern district. The author regards Transuralia as the western district [5]. The Albian assemblages of the Northern district are studied in detail in 10 sections of the wells of the Samatlor area located in the middle part of the latitudinal flow of the Ob River. Only agglutinated quartz-siliceous foraminifera of a rather diverse specific composition are found in all these sections. V.A. Marinov also investigated the Transuralian Albian foraminifera and reflected his research in the regional stratigraphic scheme, 2005 [6]. Based on the results of the Albian foraminiferal finds in the Northern district, it was possible to compare them with the Transuralian as well as those from the Canadian Province [1] [7]-[10]. Within the Samatlor area, the author has established two foraminiferal zones: Ammobaculites fragmentarius, Gaudryinopsis filiformis (the Middle Albian) and Ammotium braunsteini, Verneuilinoides borealis assanoviensis (the Upper Albian). In contrast to Transuralia, the early Albian foraminifera have not been discovered yet in the sections of the Samatlor area but in the other areas of the Northern district there are the Lower Albian Foraminiferal assemblages.

In the latest regional stratigraphic scheme [6] with regard to the Albian of Western Siberia the species Verneuilinoides borealis Tappan assanoviensis (Zaspelova) is suggested by A.V. Marinov as one of the index-species for the layers of the Middle and Upper Albian along with various species of the genus Ammosiphonia (A. jamaica – the Upper Albian, A. beresoviensis – the Middle Albian). In our view, these species as well as the genus in Transuralia and in other sections of the Northern district are not traced.
Based on the generic evidence including the chemical composition of the wall of a shell, the genus *Ammotium* characteristic of the Albanian deposits of the West-Siberian and Canadian Provinces is present. The index-species *Verneulinoides borealis* Tappan *assanoviensis* (Zaspelova) is mainly assigned to the upper layers of the Khanty-Mansiyskian Horizon and it can be an index-species for the Upper Albanian just for the same zone. Z.I. Bulatova [2] was the first to distinguish the Upper Albanian zone with the indicated index-species which coincides with the authors opinion [1]. To the species *V. borealis* Tappan *assanoviensis* (Zaspelova) the author added the second index-species *Ammotium braunsteini* (Cushman et Applin) which is no fewer than an index-species characteristic of the Upper Albanian [1][10]. As it is pointed out, the early Albanian foraminiferal assemblage is not discovered in 10 sections of the Samatlor area. Here the assemblages of the Middle and Upper Albanian are well-known.

The foraminiferal species: *Hyperammina pulvereia* Bulatova, *Reophax troyeri* Tappan, *Haplophragmoides reconditus* Bulatova, *Recurvoides leushiensis* Bulatova, *Ammobaculites fragmentarius* Cushman, *Ammomarginulina cragini* Loeblich et Tappan, *Spirolectammina cognata* Podobina, *Gaudryinopsis filiformis* (Berthelin), *G. cf. oblongus* (Zaspelova), *Pseudoverneuilina allica* Podobina are present in the Middle Albanian deposits of the Samatlor sections in the foraminiferal zone Ammobaculites fragmentarius, Gaudryinopsis filiformis. The number of the samples of the species identified is not similar. The shells of the genera: *Haplophragmoides*, *Recurvoides*, *Ammobaculites*, *Pseudoverneuilina* and *Gaudryinopsis* are dominant. The preservation of the forms is also various, but, however, the shells preserved from the destruction make it possible to establish a major systematic composition of the Middle Albanian index-species as well as *Recurvoides leushiensis* Bulatova and a species *Pseudoverneuilina allica* Podobina of the genus *Pseudoverneuilina* Podobina, 2013, are the most characteristic ones. To some extent, this species is similar with the genus *Verneuilina* Orbigny, 1840, but they are different in the quartz-siliceous wall composition (non-calcareous), a rapidly enlarging lower shell in the form of a pyramid with distinct three side angles and closely adjacent lower chambers.

The representatives of the genera: *Haplophragmoides*, *Ammomarginulina*, *Annotium*, *Verneulinoides* and *Gaudryinopsis* are the numerous ones in the Samatlor sections in the late Albanian assemblage with *Ammotium braunsteini*, *Verneulinoides borealis assanoviensis*. Among them, *Ammomarginulina obscura* (Loeblich), *Spirolectammina sibirica* Podobina, *Gaudryinopsis oblongus* (Zaspelova) are the most distinctive ones with the exception of index-species. The washed out sediment is almost completely made up of coarse and middle-grained foraminiferal shells. Shell preservation is various, however, the specific composition characteristic of the Upper Albanian in the sections of the Samatlor area is also revealed despite many destroyed and deformed forms. Pseudomorphoses of calcareous foraminifera which make it difficult to determine their systematic position are traced in individual samples. In Transuralia Albanian shells of agglutinated and calcareous-secretion foraminifera are well preserved and the previous authors distinguished systematically relatively diverse assemblages of these organisms. Probably, the Transuralia basin formed by the boreal Albanian transgression was much more deeper with a normal hydrological regime resulting in a diversity and good foraminiferal preservation.

More impoverished, mainly, middle Albanian foraminiferal assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis* is discovered in the other areas of the Northern district – Polyarnaya, borehole 1 and East-Lodochnaya, borehole 1, South-Russkaya, 4 boreholes. Characteristic Middle Albanian species which are similar to those of the Samatlor are defined except index-species. Such a similar specific composition and occurrence of course foraminiferal shells are indicative of shallow conditions of dwelling – the abundant Boreal transgression in the Middle Albanian to the latitudinal flow of the Ob River.

Many species of two Albanian assemblages (Middle and Upper) of the Samatlor and the other areas of the Northern district are vicariants or common species of those of the Canadian Province (Western Canada, Northern Alaska) which along with the West-Siberian Province are related to the Arctic palaeobiogeographical realm of just the same circumpolar belt.
The data obtained on the foraminiferal assemblages from the sections of the Yamal peninsula wells allow us to judge the systematic composition and the number of individuals of each species. The Middle Albian foraminiferal assemblage is distinguished more closely with regard to its specific composition in the sections of the wells. Early, and especially the Late Albian assemblage don’t include diverse species the shells of which are preserved to a variable degree. Although calcereus-secretion well-preserved shells were investigated in the middle Albian assemblages, they were individual or were not found at all. Obviously, the Middle Albian transgression in the Yamal peninsula as well as in the territory of all the Northern district was vast and the basin assigned to this territory was much more deeper with a good hydrological regime for foraminiferal dwellings.

2. Material and Methods

Several wells have been drilled in the Yamal peninsula and foraminifera, ostracod nuclei have been obtained from the kern in four of them by means of microfaunistic analysis. Agglutinated quartz-siliceous and isolated calcareous-secretion foraminifera shells are found in the sections of borehole 50 of the Malyginskaya area, borehole 124 of the West-Tambeiskaya and boreholes 201, 205 North-Tambeiskaya areas from the deposits of Khanty-Mansiiskian Horizon. When studying foraminifera, it became clear that most discovered samples included the Middle Albian foraminiferal assemblages. The finds of the Early and Late Albian assemblages are isolated and of a limited occurrence in their specific relation.

Numerous kern samples (nearly 70) were investigated from the identified sections of the wells using the microfaunistic method. Thus, foraminifera and ostracod nuclei were in five kern samples from the depths interval 1820.0-1725.0 m of borehole 50 of the Malyginskaya area. Content rocks consist of dark-grey argillites with some interlayers of grey aleurolites of the Khanty-Mansiiskian Horizon. Basic agglutinated quartz-siliceous forms of the Early Albian are selected in these samples. Foraminifera of more diversified species composition and of a better preservation related to the Middle Albian are selected from the washed out powders in the above-mentioned seven samples of kern rocks of just the same lithological composition from the depths internal of 1725.0-1670.0 m. Along with the foraminifera numerous and diverse ostracod nuclei are also present.

In the section of borehole 124 of the West-Tambeiskaya area in one sample at a depth of 1850.6 m, quartz-siliceous, calcareous-secretion foraminifera and ostracod nuclei are isolated. A content rock consists of dark-grey argillite with lens-like interlayers of grey aleurolite. In contrast to agglutinated quartz-siliceous forms, calcareous-secretion ones are well-preserved. The age of the rocks of the sample concerned in defined as the Early Albian.

Foraminifera and ostracod nuclei are established in the sample from a depth of 1675.8 (borehole 124). The species of the agglutinated foraminifera with a quartz-siliceous wall are distinguished in the interval of the rocks 1675.8-1673.4 m. They are diverse in the specific respect and abundant in terms of the number of specimens of each species. Just in the same section in the above selected one sample (a depth of 1655.85 m) and poorly preserved agglutinated quartz-siliceous foraminifera which are few in number and a lot of ostracod nuclei (more than 50 samples per 100 g of a rock) are discovered. Among the foraminifera the genera *Ammotium*, *Verneuilinoides* characteristic of the Upper Albian of Western Siberia are present.

In the section of borehole 201 of the North-Tambeiskaya area 22 kern samples are selected from the interval of 1631.7-1545.0 m where foraminifera and numerous ostracod nuclei are isolated from the washed out sediment. In the foraminiferal assemblage (at a depth of 1634.0 m) foraminifera are few in number, and besides agglutinated quartz-siliceous forms assigned to the Lower Albian nuclei of calcareous-secretion shells of the order of Rotaliida are found. In 20 samples from the interval at a depth of 1630.7-1548.7 m foraminifera are of a diverse systematic composition are present. Well-preserved agglutinated foraminifera predominate among which the Middle Albian species including
index-species are distinguished. Along with them, characteristic calcareous-secretion forms are selected.

3. Results of the research
The foraminiferal assemblage obtained from the kern samples of 4 well sections – 50 Maluginskaya area, 124 West-Tambeiskaya, 201, 205 North-Tambeiskaya areas include agglutinated quartz-siliceous and to a smaller extent calcareous-secretion foraminifera. The determination of the systematic composition of these foraminifera made it possible to establish three substages of the Albian layer in the Khanty-Mansiiskian Horizon. The Middle Albian substage was the most stable one which consisted of characteristic and abundant foraminiferal species. It is distinctly represented in its specific composition in all the four identified well sections. The Early and Late Albian foraminiferal assemblages stand out and they include especially the Late Albian few poorly preserved foraminifera.

3.1. The Albian biostratigraphy

| Cretaceous system – K | Lower subsystem – K₁ |
|-----------------------|-----------------------|
| Albian stage – K₁al  |
| Lower substage – K₁al₁|
| Khanty-Mansiiskian Horizon |

The Early Albian foraminiferal assemblage is established in the section of borehole 124 of West-Tambeiskaya area at a depth of 1850,0 m on the basis of the finds of quartz-siliceous and calcareous-secretion shells of foraminifera. Few ostracod nuclei are established along with foraminifera. Content rocks – dark-grey argillites have lens-like sublayers of grey aleurolites.

The species which higher in the Middle Albian became considerably diverse and got a great number of samples of each species are also specified. Here (1850,0 m), calcareous-secretion forms are of comparatively small sizes. But they, however, in contrast to agglutinated foraminifera are of a rather good preservation. The species: Haplophragmoides aff. topogorukensis Tappan, Ammobaculites cf. fragmentarius Cushman, Gaudryinopsis sp. indet., Marginulina planuiscula (Reuss), Saracenaria solita Bulatova, Gavelinella stictata (Tappan) are determined in the composition of the assemblage. Other poorly preserved shells assigned to the families of Haplophragmoididae and Ataxophragmiidae are also obtained.

It is difficult to judge the more exact age of the assemblage but the fact whether it is Albian or the Early Albian is hardly doubted.

The Early Albian foraminifera are discovered in the North-Tambeiskaya area of borehole 201 in dark-grey argillites, grey aleurolites and light-grey millstone grits selected from the interval depths of 1647,0-1631.0 m. Numerous ostracod nuclei are found along with them. Agglutinated coarse quartz-siliceous foraminiferal shells are of comparatively big sixes and the preservation of some samples is satisfactory.

Quartz-bearing pseudomorphoses of calcareous forms predominantly of the order of Rotaliida are also established.

The foraminiferal species of the following composition: Saccammina micra Bulatova, Labrospira rotunda Podobina, Haplophragmoides aff. variabilis Podobina, Ammobaculites wenonahae Tappan, Ammoscalaria aff. cenomacina Podobina, Ammomarginalina obscura (Loeblich), Flabellammina aff. acuminata Podobina, Spiroplectammina longula Podobina, Verneulinoides aff. borealis Tappan, Gauryinopsis aff. teilleuri Tappan, Trotianina imiatensis Tappan are determined in the foraminiferal assemblages at a depth of 1634,4 m (borehole 201). According to the species composition, the assemblage being studied is for the most part close to the Albian assemblages discovered to the interfluve of the Taz and Pur Rivers (the South-Russkaya area, borehole 55). Judging by the systematic foraminiferal composition and position in the section, it dates back to the Early Albian. (Fig. 1)
The Albian species known in the formation of Topagoruk of Northern Alaska [8].

Middle substage – K_al2
Khanty-Mansiiskian Horizon

The most diverse and numerous agglutinated quartz-siliceous and calcareous-secretion assemblages are discovered in the section of borehole 50 of the Malyginskaya area. The foraminifera are found in the depths intervals of 1680.05-1675.60 m. In the samples from this particular interval the author of the paper has established the Middle Albian assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis*. The species of *Haplophragmoides topagorukensis* Tappan prevail in the composition of the assemblage. The species: *Psammospaera laevigata* White, *Labrospira aff. rotunda* Podobina, *Haplophragmoides topagorukensis* Tappan, *Recurvoides aff. leuhiensis* Bulatova, *Ammobaculites fragmentarius* Cushman, *Psudobolivina contorta* Bulatova, *Gaudryinopsis filiformis* (Berthelin), *Miliammina manitobensis* Wickenden, *Lenticulina topagorukensis* Tappan, *Saracenaria solita* Bulatova, *Gavelinella aff. strictata* (Tappan) are determined in the assemblage at a depth of 1675,6 m. In the assemblage along with the dominating agglutinated quartz-siliceous forms, calcareous-secretion shells of the genera *Lenticulina, Saracenaria, Gavelinella* occur. A similar diverse assemblage with well-preserved foraminiferal shells is first discovered among the analogous assemblages of the Northern palaeobiogeographical district. Many species of this assemblage are characteristic of the Albian assemblage of the Canadian Province [8] [9]. Fig. 2, 2a. Agglutinated quartz-siliceous as well as calcareous-secretion foraminifera selected from the depths intervals of 1675.8-1673.4 m in the section of borehole 124 of the West-Tambeiskaya area are investigated. Separate ostracod nuclei are found in a sample at a depth of 1675.8 m. The species: *Saccammina aff. sphaerica* (M. Sars), *Reophax aff. sherborniana* (Chapman), *Reophax inordinatus* Young, *Haplophragmoides topagorukensis* Tappan, *Protobolivina contorta* Bulatova, *Gaudryinopsis filiformis* (Berthelin), *Miliammina manitobensis* Wickenden, *Lenticulina topagorukensis* Tappan, *Gavelinella aff. strictata* (Tappan) are determined in the middle Albian foraminiferal assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis* (Fig. 3). A similar Middle Albian assemblage is well known in the other sections of the Yamal peninsula wells. As it was pointed out earlier, the most abundant and diverse assemblage concerned is referred to as the section of Malyginskaya borehole 50 at a depth of 1675,0 m. According to its specific composition, the assemblage has much in common with that of the Canadian Province (general, vicarious species, geographical subspecies).

Numerous foraminifera and ostracod nuclei are discovered in the section of boreholes 201 and 205 of the North-Tambeiskaya area (the Yamal peninsula) in the intervals at the depths of 1630.7-1548.7 m (borehole 201) and 1881.6-1825.0 m (borehole 205) from the samples of dark-grey argillites. Calcareous-secretion shells are studied in addition to agglutinated quartz-siliceous ones. *Ammobaculites fragmentarius* and *Gaudryinopsis filiformis* are the index-species for the foraminiferal assemblages from these sections.

The species: *Psammospaera laevigata* White, *Saccammina complanata* (Franke), *Hyperammina aptica* (Dampel et Mjatliuk), *Reophax inordinatus* Young, *Labrospira aff. collyra* (Nauss), *Haplophragmoides topagorukensis* Tappan, *Ammobaculites fragmentarius* Cushman, *Trochammina reinwarteri* Cushman et Applin, *Gaudryinopsis nanushakensis* Tappan, *Gaudryinopsis filiformis* (Berthelina), *Uvigerinammina manitobensis* (Wickenden), *Miliammina avumensis* Tappan, *Saracenaria projectura* Stelk et Wall, *Pallaimorphina ruckeriae* Tappan, *Eponides morani* Tappan are established in the composition of the assemblage along with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis* (the North-Tambeiskaya area, borehole 201) (Fig. 4). The representatives of the genus *Haplophragmoides*, especially of the species *H. topagorukensis* Tappan are abundant. The shells are mainly well-preserved and they species constitute the Middle Albian assemblage known in the previous sections of the Yamal peninsula wells and some other sections of the North district of the West-Siberian Province as well as in the Western district – Transuralia. A similar foraminiferal
assemblage is observed in the section of borehole 205 at a depth of 1836.45 m (the North-Tambeiskaya area). The composition of the assemblage includes the following species: *Haplophragmoides topagorukensis* Tappan, *Ammobaculites aff. fragmentarius* (Cushman), *Ammonmarginulina obscura* (Loeblich), *Haplophragmium aff. ivesi* Podobina, *Flabellammina aff. acuminata* Podobina, *Uvigerinammina manitobensis* (Wickenden), *Dentalina aff. basiplanata* Cushman, *Marginulina aff. curvatura* Cushman, *M. similis* Orb. *obliquenodes* Bandy, *Marginulina sphaerica* Podobina et Orlov, *Saracenaria solita* Bulatova, *Saracenaria projecta* Stelk et Wall, *Eponides morani* Tappan, *Rosalina ? interposita* Mjaflik. The last 8 species are calcareous-secretion brownish shells belonging to the orders of Lagenida and Rotaliida (Fig. 5).

Somewhat different Middle Albian foraminiferal assemblage along with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis* is discovered just higher in the section at a depth of 1830.6 m. The species: *Reophax inordinatus* Young, *Ammobaculites fragmentarius* (Cushman), *Ammonmarginulina obscura* (Loeblich), *Uvigerinammina manitobensis* (Wickenden), *Trochammina aff. wetteri* Stelk et Wall *tumida* Podobina, T. *imiatensis* Tappan, *Verneuilinoides aff. borealis* Tappan *assanoviensis* (Zaspelova), *Gaudryinopsis filiformis* (Berthelin), G. *aff. nanushukensis* Tappan, *Marginulina aff. similis* Orb. *obliquenodes* Bandy are determined in its composition. The shells in this assemblage are predominantly agglutinated coarse grained with a quartz-siliceous wall. Calcareous-secretion forms – the species of *Marginulina aff. similis* Orb. *obliquenodes* Bandy. But, however, both index-species which are characteristic of the Middle Albian occur [10].

All the investigated shells are well-preserved and known in the Transuralian deposits, as well as Topagoruk formation of Northern Alaska [8].

Upper substage – K$_{al_{1}}$
Khatny-Mansiiskian Horizon

One sample selected from a depth of 1655.85 m (borehole 124 of the West-Tambeiskaya area) is situated in the upper-lying deposits of the Khanty-Mansiiskian Horizon. Slightly abundant, well-preserved agglutinated quartz-siliceous foraminifera and a great number of ostracod nuclei are found in it. *Haplophragmoides cf. variabilis* Podobina, *Ammotium cf. braunsteini* (Cushman et Applin), *Verneuilinoides sp. indet.* and poorly preserved taxa of the families of Haplophragmoididae and Ataxophragmididae are determined along them. The assemblage in view of the representatives of the genera of *Ammotium* and *Verneuilinoides* is typical of the Upper Albian of Western Siberia.

4. Conclusion

The new foraminifer finds from the drilled four sections of the Yamal peninsula wells have provided an opportunity to extend our knowledge about the occurrence of the Albian sea deposits in the Northern palaeobiogeographical district of Western Siberia. All the Albian assemblages of foraminifera are discovered in dark-grey argillites with the interlayers of grey aleurolites of the Khanty-Mansiiskian Horizon. Foraminifera mainly consist of agglutinated quartz-siliceous and to a smaller extent calcareous-secretion shells. The Early Albian foraminiferal assemblage was not completely diverse and it was discovered in two sections of borehole 124 of the West-Tambeiskaya and borehole 201 of the North-Tambeiskaya area.

Fairly diverse foraminiferal assemblages integrated in one Middle Albian assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis* are explored in all the four sections of the wells: 50 Malyginskaya area, 124 West-Tambeiskaya and 201, 205 of the North-Tambeiskaya areas. Many species of the Middle Albian assemblage (the Samatlor and the other areas) of the West Siberian Northern palaeobiogeographical district are also discovered in the assemblage from the Western one. At the same time, in comparison with the Middle Albian Transuralian assemblage [2], the Yamal, Samatlor assemblages are significantly impoverished in their specific composition. The Boreal transgression in Transuralia seemed to have formed a much more deeper and comparatively warmer
basin in which the conditions for foraminiferal existence were comparatively good. In the Yamal shallow basin the conditions of dwelling were less favourable. Many foraminiferal shells, however, are well-preserved and representative samples of calcareous-secretion forms are also found. The Late Albian assemblage of foraminifera (borehole 124, the West-Tambeiskaya area) is established in the upper layers of the Khanty-Mansiiskian Horizon. The assemblage of interest includes the species of the genera of *Ammotium* and *Verneuilinoides*. But their poor preservation and separate finds do not allow us with confidence to assign their age to the Late Albian. Many species of the Albian assemblages, especially those from the Middle Albian of the West-Siberian Province have their analogs or similar species in the Albian deposits of the Canadian Province [8] [9]. Judging by the similarity in the foraminiferal composition, both of the provinces are related to the Arctic palaeobiogeographical realm of just the same circumpolar belt.

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Figure 1. Early Albian foraminiferal assemblage Western Siberia. North-Tambeliskaya well 201, depth 1634.3 m; Khanty-Mansiiskian Horizon, Lower Albian

1 – Saccammina micra Bulatova; 2-6 – Labrospira rotunda Podobina; 7-13 – Haplophragmoides aff. variabilis Podobina; 14-20 – Ammomarginulina obscura (Loeblich); 21-23 – Trochammina imiatensis Tappan; 24 – Flabellammina aff. acuminata Podobina; 25 – Spiroplectammina longula Podobina; 26-
33 – *Verneulinoides* aff. *borealis* Tappan; 34 – *Gaudryinopsis* aff. *teilleuri* Tappan; 35–38 – kvarz-siliceus foraminiferal kernels of Rotaliida

**Figure 2.** Foraminiferal assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis*. Western Siberia, Malyginskaya well 50, depth 1675.0 m; Khanty-Mansiiskian Horizon, Middle Albian

1 – *Psammosphaera laevigata* White; 2-3 – *Labrospira* aff. *rotunda* Podobina; 4-22 – *Haplophragmoides topagorukensis* Tappan; 23-25 – *Recurvoides* aff. *leashiensis* Bulatova; 26-29 – *Ammobaculites wenonahae* Tappan; 30-31 – *Pseudobolivina contorta* Bulatova; 32-35 –
Gaudryinopsis filiformis (Berthelin); 36-40 – Miliammina manitobensis Wickenden; 41-43 – Lenticulina topagorukensis Tappan; 44-45 – Saracenaria solita Bulatova; 46-49 – Gavelinella aff. stictata (Tappan)

Figure 2a. Foraminiferal assemblage with Ammobaculites fragmentarius, Gaudryinopsis filiformis. Western Siberia, Malyginskaya well 50, depth 1675.0 m; Khanty-Mansiiskian Horizon, Middle Albian

1 – Psammosphaera laevigata White; 2-3 – Labrospira aff. rotunda Podobina; 4-24 – Haplophragmoides topagorukensis Tappan; 25-27 – Recurvvoides aff. leushiensis Bulatova; 28-31 – Ammobaculites fragmentarius Cushman; 32-33 – Pseudobolivina contorta Bulatova; 34-37 – Gaudryinopsis filiformis (Berthelin); 38-42 – Miliammina manitobensis Wickenden; 43-44 –
*Lenticulina topagorukensis* Tappan; 45-47 – *Saracenaria solita* Bulatova; 48-51 – *Gavelinella* aff. *stictata* (Tappan)

**Figure 3.** Foraminiferal assemblage with *Ammobaculites* *fragmentarius*, *Gaudryinopsis* *filiformis*. Western Siberia, West-Tambeiskaya well 124, depth 1673.40 m; Khanty-Mansiiskian Horizon, Middle Albian

1 – *Saccammina* aff. *sphaerica* (M. Sars); 2 – *Reophax* aff. *sherborniana* (Chapman); 3 – *Reophax* aff. *inordinatus* Young; 4-8 – *Haplophragmoides* *topagorukensis* Tappan; 9-12 – *Ammobaculites*
Figure 4. Foraminiferal assemblage with *Ammobaculites fragmentarius*, *Gaudryinopsis filiformis*, *Labrospira aff. collyra* (Nauss); 4-6 – *Haplophragmoides topagorukensis* Tappan; 7 – *Uvigerinammina manitobensis* (Wickenden); 8-11 – *Ammobaculites fragmentarius* Cushman; 12-14 – *Gaudryinopsis filiformis* (Berthelin); 15 – *Miliammina avunensis* Tappan; 16 – *Saracenaria projectura* Stelk et Wall; 17-23 – *Eponides morani* Tappan; 24-25 – *Pallaimorphina ruckerae* Tappan
Figure 5. Foraminiferal assemblage with Ammobaculites fragmentarius, Gaudryinopsis filiformis.
Western Siberia, North-Tambeiskaya well 124, depth 1836.45 m;
Khanty-Mansiiskian Horizon, Middle Albian
1-6 – Haplophragmoides topagorukensi Tappan; 7-10 – Ammobaculites fragmentarius Cushman; 11-14 – Ammomarginulina obscura (Loeblich); 15 – Haplophragmium aff. illevi Podobina; 16-17 – Uvigerinammina manitobensis (Wickenden); 18-19 – Dentalina aff. basiplanata Cushman; 20 – Marginulina aff. curvatura Cushman; 21-22 – M. rimilis Orb. obliquinoides Bandy; 23-24 – Marginulina sphaerica Podobina et Orlov; 25-26 – Saracenaria solita Bulatova; 27 – Saracenaria projectura Stelck et Wall; 28-31 – Eponides morani Tappan; 32 – Rosalina ? interposita Mjatliuk