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Dinocyst Biostratigraphy of the Upper Cretaceous of Northern Siberia

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Abstract—A stratigraphic chart is developed of the Upper Cretaceous deposits of northern Siberia based on dinocysts. It covers the period from the Upper Cenomanian to the Maastrichtian, including 15 biostratigraphic units (beds with characteristic assemblages or local zones), and is correlated with the inoceram zonation.

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Key words: Dinocysts, Upper Cretaceous, Cenomanian, Turonian, Coniacian, Santonian, Campanian, Maastrichtian, northern Siberia, biostratigraphy.

INTRODUCTION

In the Late Cretaceous, Western Siberia was a vast epicontinental basin. Upper Cretaceous deposits are covered almost everywhere by Cenozoic deposits. Upper Cretaceous natural outcrops are found in the Ust'-Yenisei and Khatanga regions, on the eastern slope of the Ural Mountains, and in the Polar Fore-Urals. These sections are enriched with fossils and serve as standards for parallel biostratigraphic zonation based on various faunal and floral groups. However, their facial composition may differ significantly from that of beds of inner regions of Western Siberia, where the major accumulations of oil and gas are situated. Therefore, zonations that are developed on the basis of reference sections can be used successfully only after they are tested within *closed territories.* Thus, groups of fossil remains that in the least degree depend on facial conditions are of particular importance. Dinoflagellate cysts (Pls. 5, 6) are a relatively poorly understood group of microfossils. The purpose of the present investigation was to perform a detailed subdivision of the Upper Cretaceous deposits of northern Siberia based on the changes revealed in the taxonomic composition of dinocyst assemblages.

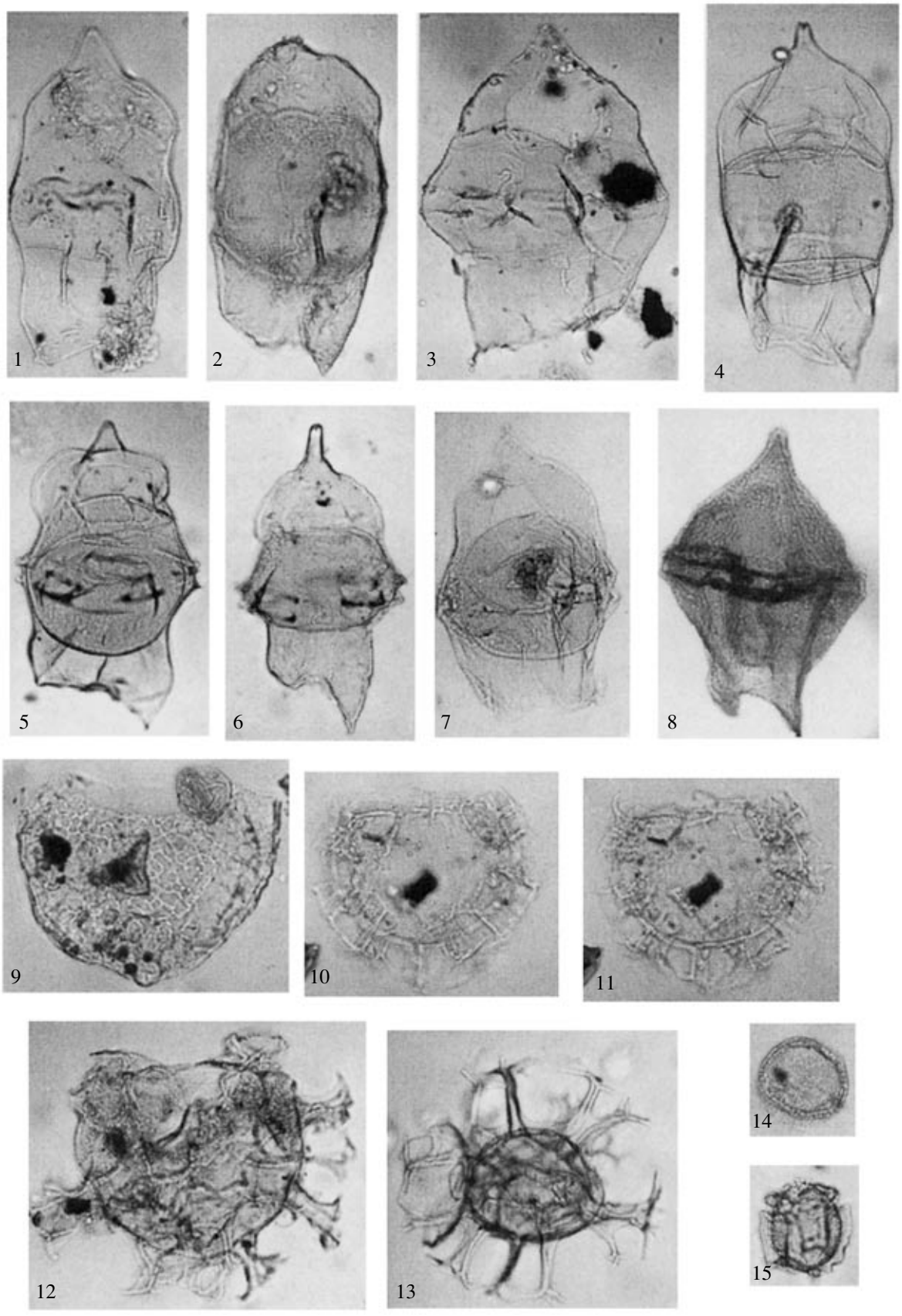
MATERIAL AND METHODS

Dinocysts from the sections of Ust'-Yenisei and Khatanga regions, the Polar Fore-Urals, and boreholes of Western Siberia and the Kara Sea shelf were studied (Fig. 1). The Upper Cretaceous reference section (Cen-

Explanation of Plate 5

Fig. 1. *Chatangiella bondarenkoi* (Vozzhennikova) Lentin et Williams, preparation TsSGM, no. 1212, Upper Santonian.
Fig. 2. *Chatangiella chetiensis* (Vozzhennikova) Lentin et Williams, preparation TsSGM, no. 1227, Lower Santonian.
Fig. 3. *Chatangiella ditissima* (McIntyre) Lentin et Williams, preparation TsSGM, no. 1192.4, Lower Campanian.
Fig. 4. *Isabelidinium rectangulatum* Lebedeva, preparation TsSGM, no. 1212, Upper Santonian.
Fig. 5. *Chatangiella granulifera* (Manum) Lentin et Williams, preparation TsSGM, no. 1219.1, Upper Santonian.
Fig. 6. *Chatangiella tanamaensis* Lebedeva, preparation TsSGM, no. 1226, Lower Santonian.
Fig. 7. *Chatangiella spectabilis* (Alberti) Lentin et Williams, preparation TsSGM, no. 1227.2, Lower Santonian.
Fig. 8. *Cerodinium diebelii* (Alberti) Lentin et Williams, preparation TsSGM, no. 47.4, Coniacian.
Fig. 9. *Canningia macroreticulata* Lebedeva, preparation TsSGM, no. 315.3, Upper Coniacian.
Figs. 10 and 11. *Cauveridinium membraniphorum* (Cookson et Eisenack) Masure, preparation TsSGM, no. 380.3, Upper Cenomanian.
Fig. 12. *Heterosphaeridium difficile* (Manum et Cookson) Ioannides, preparation TsSGM, no. 1228.2, Upper Coniacian.
Fig. 13. *Achomosphaera ramulifera* (Deflandre) Evitt, preparation TsSGM, no. 1219.1, Upper Cantonian.
Fig. 14. *Chlonoviella agapica* Lebedeva. TsSGM, no. 379.2, Lower Turonian.
Fig. 15. *Rhyptocorys veligera* (Deflandre) Lejeune-Carpentier et Sarjeant, preparation TsSGM, no. 1219.2, Upper Santonian.
Figs. 1–7, 12, 13, 15. Upper Cretaceous deposits on the Seida River (Polar Fore-Urals). Fig. 8. Upper Cretaceous deposits on the Tanama River (Ust'-Yenisei Region). Fig. 9. Upper Cretaceous deposits on the Yangoda River (Ust'-Yenisei Region). Figs. 10, 11, 14. Upper Cretaceous deposits on the Nizhnyaya Agapa River (Ust'-Yenisei Region). Magnification, ×500.

Plate 5



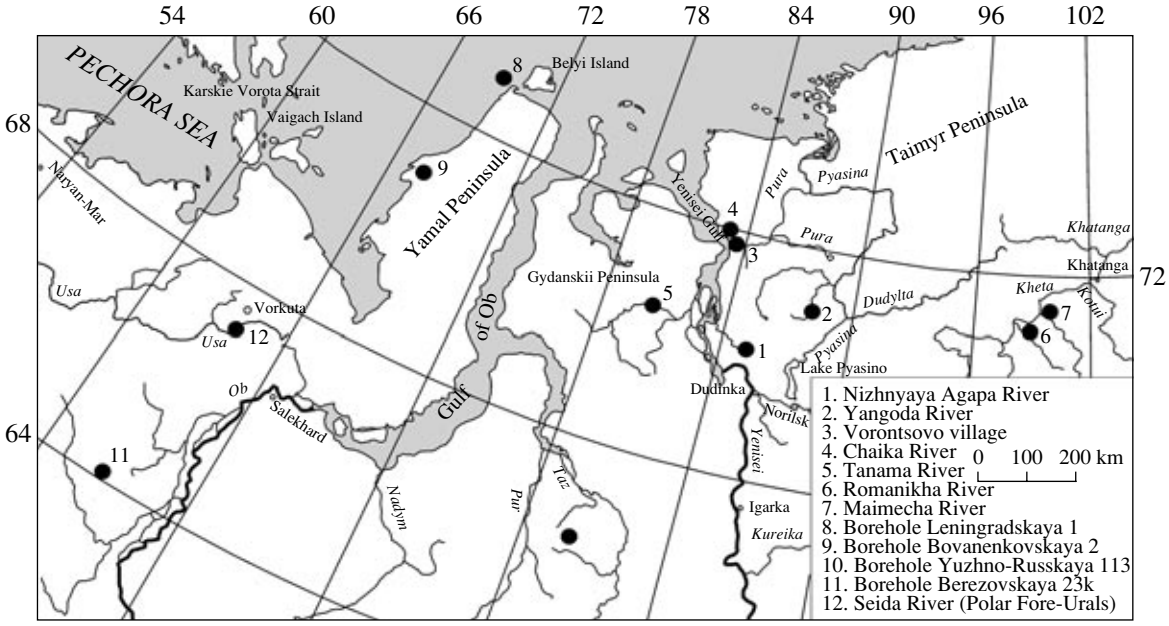


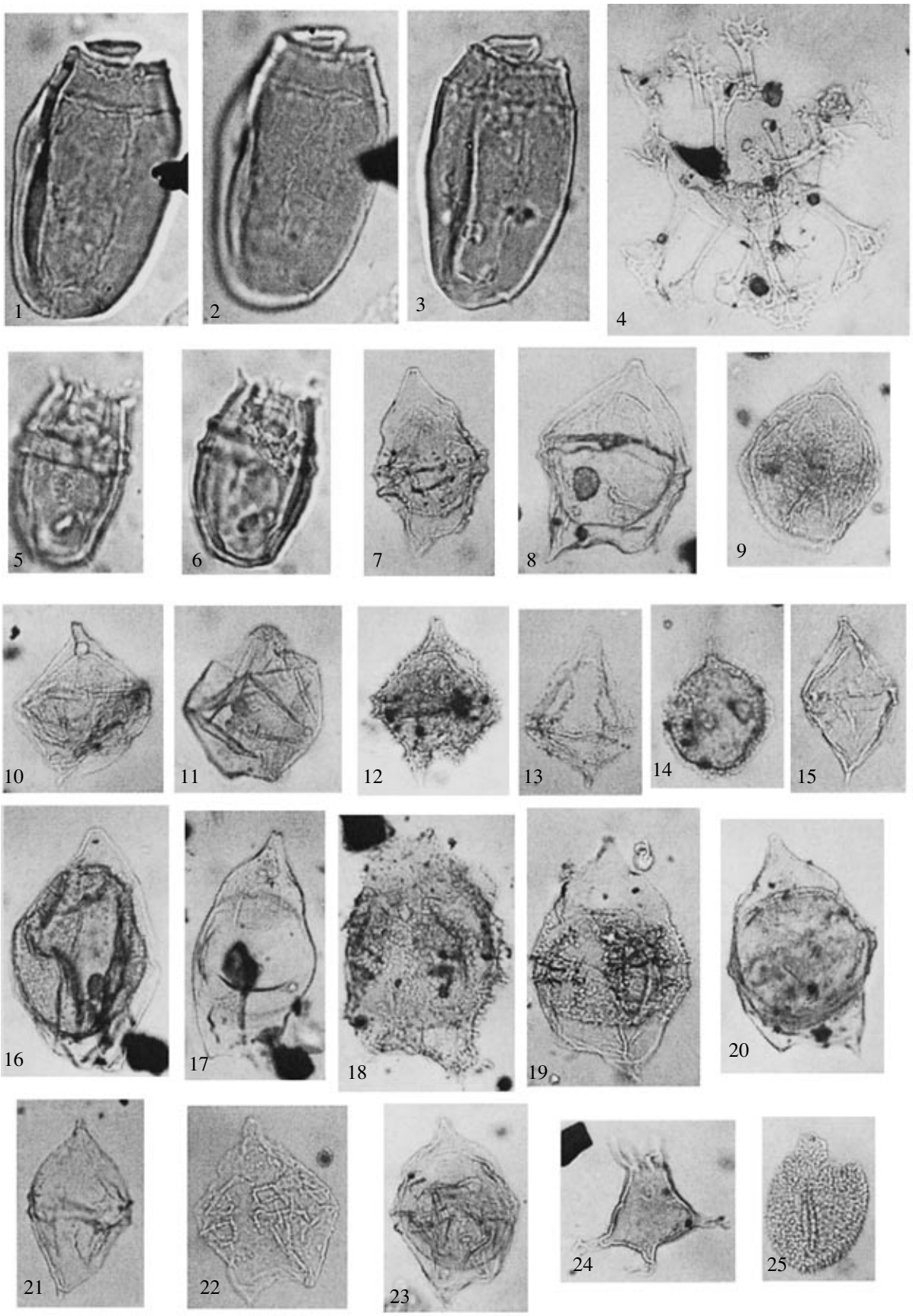
Fig. 1. Geographical position of the sections studied.

omanian–Maastrichtian) of the Ust'-Yenisei Region is the section in northern Siberia where sequences of inoceram and dinocyst zones and local zones are most complete. However, even this section contains numerous gaps because either some constituents do not overlap, or deposits are absent, or there were short periods of continental sedimentation. This fact is accounted for by the position of the Ust'-Yenisei Gulf in the marginal zone of the West Siberian Paleobasin, which was most strongly affected by sea level fluctuations. The study of central and northern sections of Western Siberia was supposed to fill certain informational gaps.

Explanation of Plate 6

Figs. 1 and 2. *Fromea chytra* (Drugg) Stover et Evitt, preparation TsSGM, no. 1192.1, Lower Campanian, ×1250.
Fig. 3. *Fromea chytra* (Drugg) Stover et Evitt, preparation TsSGM, no. 1192.2, ×1250.
Fig. 4. *Oligosphaeridium pulcherrimum* (Deflandre et Cookson) Davey et Williams, preparation TsSGM, no. 245.4, Lower Coniacian.
Figs. 5, 6. *Dorocysta* sp. *A.*, preparation TsSGM, no. 235.6, Upper Turonian.
Fig. 7. *Chatangiella vnigrii* (Vozzhennikova) Lentin et Williams, preparation TsSGM, no. 1192.4, Lower Campanian.
Fig. 8. *Eurydinium saxoniense* Marshall et Batten, preparation TsSGM, no. 380.1.4, Upper Campanian.
Fig. 9. *Geiselodinium cenomanicum* Lebedeva, preparation TsSGM, no. 362.5, Upper Cenomanian.
Fig. 10. *Alterbidinium "daveyi"* (Stover et Evitt) Lentin et Williams, preparation TsSGM, no. 362.2, Upper Cenomanian.
Fig. 11. *Pierceites pentagonus* (May) Habib et Drugg, preparation TsSGM, no. 367.4, Upper Cenomanian.
Fig. 12. *Spinidinium echinoideum* (Cookson et Eisenack) Lentin et Williams, preparation TsSGM, no. 1228.2, Upper Coniacian.
Fig. 13. *Spinidinium uncinatum* May, preparation TsSGM, no. 1209.3, Upper Santonian.
Fig. 14. *Chlamydophorella nyei* Cookson et Eisenack, preparation TsSGM, no. 364.4, Upper Cenomanian.
Fig. 15. *Laciniadinium rhombiforme* (Vozzhennikova) Lentin et Williams, preparation TsSGM, no. 1202.1, Lower Campanian.
Fig. 16. *Trithyrodinium* sp. *A*, preparation TsSGM, no. 1228.2, Upper Coniacian.
Fig. 17. *Isabelidinium microarmum* (McIntyre) Lentin et Williams, preparation TsSGM, no. 16.8, Campanian.
Fig. 18. *Chatangiella spinata* Lebedeva, preparation TsSGM, no. 26.3, Campanian.
Fig. 19. *Chatangiella manumii* (Vozzhennikova) Lentin et Williams, preparation TsSGM, no. 1209.4, Upper Santonian.
Fig. 20. *Chatangiella cassidea* Lebedeva, preparation TsSGM, no. 1227.2, Lower Santonian.
Fig. 21. *Laciniadinium arcticum* (Manum et Cookson) Lentin et Williams, preparation TsSGM, no. 1194.1, Lower Campanian.
Fig. 22. *Spinidinium sverdrupianum* (Manum) Lentin et Williams, preparation TsSGM, no. 218.2, Lower Coniacian.
Fig. 23. *Chatangiella serratula* (Cookson et Eisenack) Lentin et Williams, preparation TsSGM, no. 1217.3, Upper Santonian.
Fig. 24. *Dorocysta litotes* Davey, preparation TsSGM, no. 1228.1, Upper Coniacian.
Fig. 25. *Membranosphaera maastrichtica* Samoilovitch, preparation TsSGM, no. 1230.1, Upper Coniacian.
Figs. 1–3, 7, 12, 13, 15, 16, 19–21, 23–25. Upper Cretaceous deposits on the Seida River (Polar Fore-Urals). Figs. 4–6, 22. Upper Cretaceous deposits on the Yangoda River (Ust'-Yenisei Region). Figs. 8–11, 14. Upper Cretaceous deposits on the Nizhnyaya Agapa River (Ust'-Yenisei Region). Figs. 17, 18. Upper Cretaceous deposits on the Tanama River (Ust'-Yenisei Region). Magnification, is ×500.

Plate 6



As a dinocyst-based biostratigraphical investigation of the Upper Cretaceous of Siberia was carried out for the first time, the following procedure of zonation was used. For each section, the sediments were subdivided on the basis of successive changes in dinocyst assemblages. Particular beds with dinocysts were revealed, representing comprehensively grounded biostratigraphic units. In reference sections, they were correlated with zones and local zones based on other groups of fossil organisms. The boundaries of the biostratigraphic units were defined predominantly on the basis of the first and last appearances of particular dinocyst taxa; the epiboles of particular species and the list of characteristic forms were used for the substantiation of dinocyst local zones. Then, these particular zonations were correlated with each other and with the dated reference succession of beds with dinocysts of the Upper Cretaceous section of the Ust'-Yenisei Region.

Collection no. 1086 is kept at the Central Siberian Geological Museum (TsSGM) of the Joint Institute of Geology, Geophysics, and Mineralogy of the Siberian Division of the Russian Academy of Sciences, Novosibirsk.

CHARACTERISTICS OF THE SECTIONS STUDIED

Ust'-Yenisei Region

Within the Ust'-Yenisei Depression, the most complete sections of the Upper Cretaceous outcrop, with all six stages present: sections along the Nizhnyaya Agapa (Cenomanian–Middle Turonian), Chaika (Turonian), Yangoda (Upper Turonian–Coniacian), and Tanama rivers (Santonian–Maastrichtian) and near the village of Vorontsovo (Upper Coniacian) (Fig. 1). The Upper Cretaceous composite section is compiled on the basis of these five main sections, each is represented by dozens of outcrops in particular isolated regions. The geological age of exposures of Upper Cretaceous marine deposits in the Ust'-Yenisei Region (from the Cenomanian to Santonian) was substantiated by numerous finds of inocerams and relatively rare ammonites. The sections were described, and their composite characteristics were given elsewhere (*Stratigraphy of Upper Cretaceous Deposits…*, 1986, 1989; Zakharov and Khomentovskii, 1989; Zakharov et al., 1989, 1991, 1998, 2003). The stratigraphic zonation of the Upper Cretaceous deposits of the Ust'-Yenisei Region based on dinocysts, spores, and pollen grains is correlated with the inoceram chart provided by Ilyina et al. (1994) and Zakharov et al. (1997, 2002).

Khatanga Region

Within the Khatanga Depression, natural outcrops show the most complete and paleontologically full section of the Mesozoic. The Upper Cretaceous deposits along the Kheta River are mostly of the continental and lagoonal origin. Only during the Santonian–Campanian transgression, marine deposits of the Mutino Formation were accumulated. Layer-by-layer lithological, macrofaunal, and palynological characteristics of the section as well as inoceram and dinocyst zonations were previously published (Khomentovskii et al., 1999).

Western Siberia

Borehole Bovanenkovskaya 2

Borehole Bovanenkovskaya 2, which is situated in the Yamal Peninsula, in the region of Kharasavei Peninsula (Fig. 1), shows a continuous succession of the Gan'kino and Tibeisale formations. I studied samples from a depth of 503.0–408.8 m. Lebedeva (2006) provided the palynological characteristics of the section.

Borehole Yuzhno-Russkaya 113

Borehole Yuzhno-Russkaya 113 was drilled in near-roof region of the Yuzhno-Russkaya positive structure of the Pur-Taz interfluve (Fig. 1). It outcrops the upper Pokurskaya, Kuznetsovo, and the lower Berezovo formations. The study of microphytofossils allowed Lebedeva et al. (2004) to recognize three palynological units and four beds with dinocyst, correlated with the Ust'-Yenisei zonation.

Borehole Berezovskaya 23k

Borehole Berozovskaya 23k is situated in northwestern peripheral part of Western Siberia, in the interfluve of the Severnaya Sos'va, Khulga, and Kempazh rivers (Fig. 1) and outcrops the upper Uvat and Kuznetsovo formations. The palynological study of the borehole was accomplished by Denisyukova (1994), who described from the interval of 219.0–173.0 m a pollen-and-spore assemblage that is analogous to Turonian palynological assemblages from the Kuznetsovo Formation of various regions of Western Siberia. Samples from the same interval contain unidentifiable microphytoplankton. Denisyukova also mentioned a rich assemblage of Santonian–Campanian palynomorphs from the interval of 145.0–65.0 m of depth, in which she determined several dinocyst taxa. Unfortunately, this portion is absent from our borehole material. All the samples studied contained diverse assemblages of microphytofossils: spores and pollen grains of higher plants, dinoflagellate cysts, acritarchs, and prasinophytes. The successive change of dinocyst assemblages made it possible to reveal the following biostratigraphic units (local zones) (Fig. 2).

Beds with *Rhiptocorys veligera–Oligosphaeridium poculum*

Characteristic assemblage. *Chlonoviella agapica, Rhiptocorys veligera, Microdinium* spp. (*M. ornatum, M. glabrum, M. setosum*, and *M. distinctum*), *Chlamydophorella discreta, C. nyei,* and *Palaeohystrichophora*

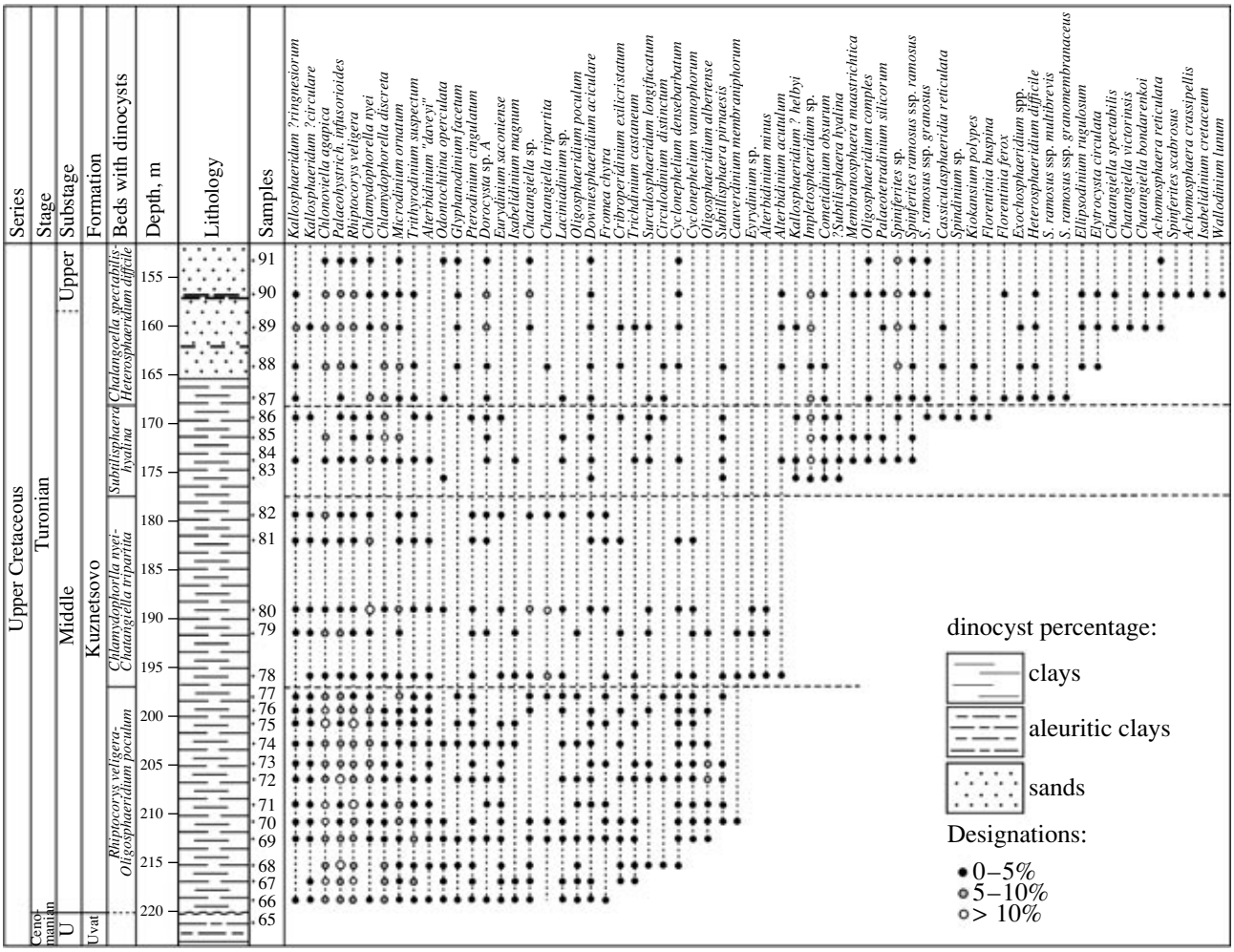


Fig. 2. Stratigraphic range of dinocysts in the Upper Cretaceous section of borehole Berezovskaya 23k. Designations: (*Palaeohystrich.*) *Palaeohystrichophor*; (*S.*) *Spiniferites*.

infusorioides are dominants. *Eurydinium saxoniense, Alterbidinium "daveyi,"* and *Trithyrodinium suspectum* play a significant role. *Pterodinium cingulatum, Cyclonephelium vannophorum, Circulodinium densebarbatum, Cribroperidinium exilicristatum, Odontochitina operculata, Oligosphaeridium albertense, O. poculum*, and *Chatangiella tripartita* are accompanying elements.

Locality. Borehole Berezovskaya 23k, 220–197 m of depth, sample nos. 66–77.

Beds with *Chlamydophorella nyei–Chatangiella tripartita*

Characteristic assemblage. *Chlamydophorella nyei* prevails. *Chatangiella tripartita* is a characteristic element of the assemblage. *Chlonoviella agapica, Microdinium ornatum, Rhiptocorys veligera, Palaeohystrichophora infusorioides*, and *Chlamydophorella discreta* are accompanying elements. *Alterbidinium acutulum* and *A. minus* appear.

Lower boundary. *Chatangiella tripartita* increases in number; and *Eurydinium saxoniense, Oligosphaeridium albertense, O. poculum, Cauveridinium membraniphorum*, and some other taxa disappear.

Locality. Borehole Berezovskaya 23k, 197–174 m of depth, sample nos. 197–174.

Beds with *Subtiliasphaera hyalina*

Characteristic assemblage. Impletosphaeridium sp. is a dominant. *Subtilisphaera hyalina* is a characteristic member. *Cometodinium obscurum, Coronifera striolata, Surculosphaeridium longifurcatum, Chatangiella* sp., *Laciniadinium arcticum, Palaeohystrichophora infusorioides, Trithyrodinium* sp., *Microdinium* sp., *Subtilisphaera pirnaensis, Membranosphaera maastrichtica*, and diverse *Spiniferites* are present.

Lower boundary is marked by the appearance of *Subtilisphaera hyalina* and some other taxa.

Locality. Borehole Berezovskaya 23k, 178–164.6 m of depth, sample nos. 83–87.

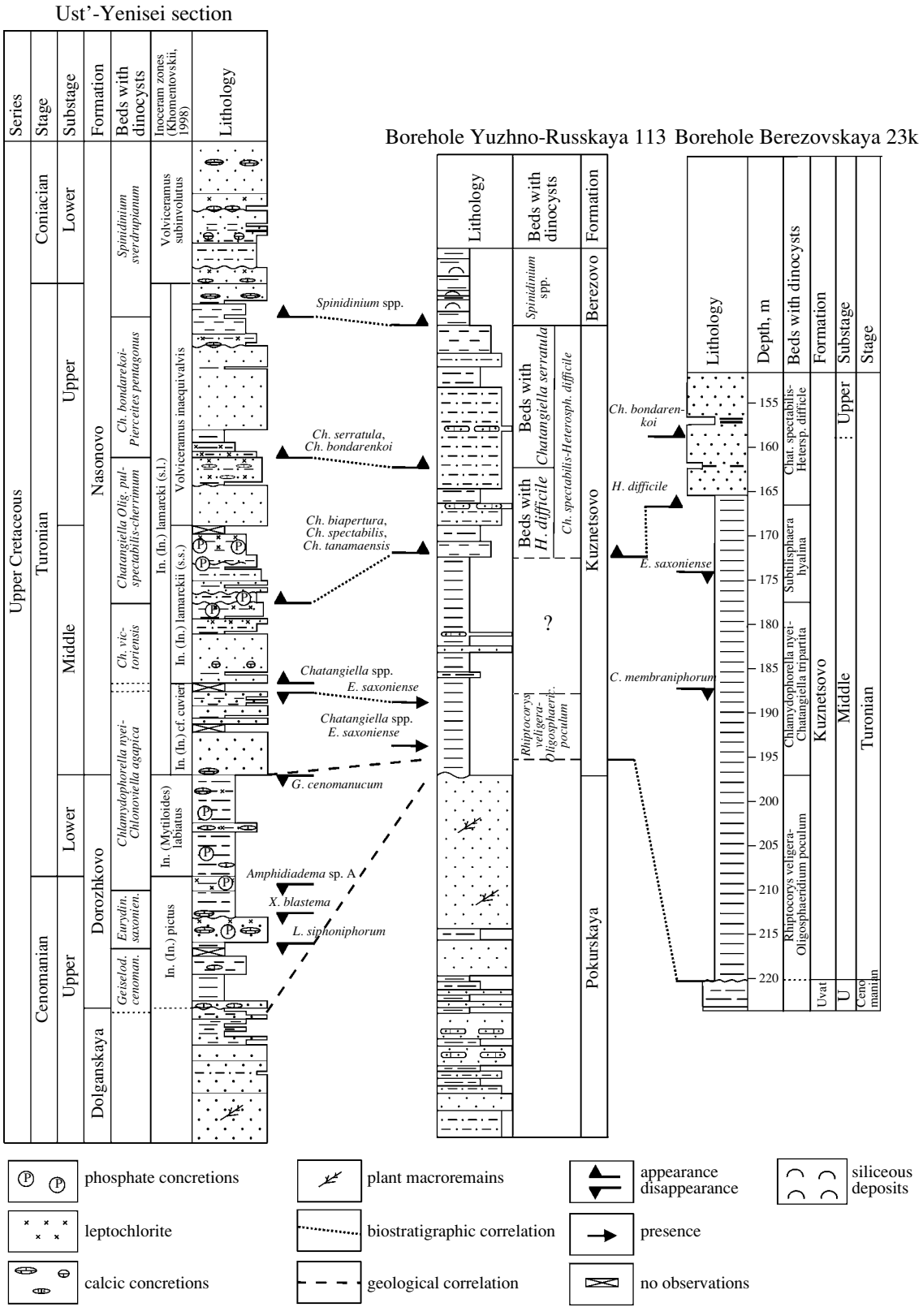


Fig. 3. Correlation of boreholes Yuzhno-Russkaya 113 and Berezovskaya 23k and the Upper Cretaceous reference section of the Ust'-Yenisei Region. Designations: (Berez.) Berezovo; (U) Upper; (*Ch.*) *Chatangiella*; (*Olig.*, *Oligosphaerid.*) *Oligosphaeridium*, (*Eurydin. saxonien., E. saxoniense*) *Eurydinium saxoniense*; (*Geiselod. cenoman., G. cenomanicum*) *Geiselodinium cenomanicum*; (*In.*) *Inoceramus*; (*L. siphoniphorum*) *Litosphaeridium siphoniphorum*; (*X. blastema*) *Xenascus blastema*; (*H. difficile, Heterosph. difficile*) *Heterosphaeridium difficile*; (*C. membraniphorum*) *Cauveridinium membraniphorum*; for other designations, see Fig. 2.

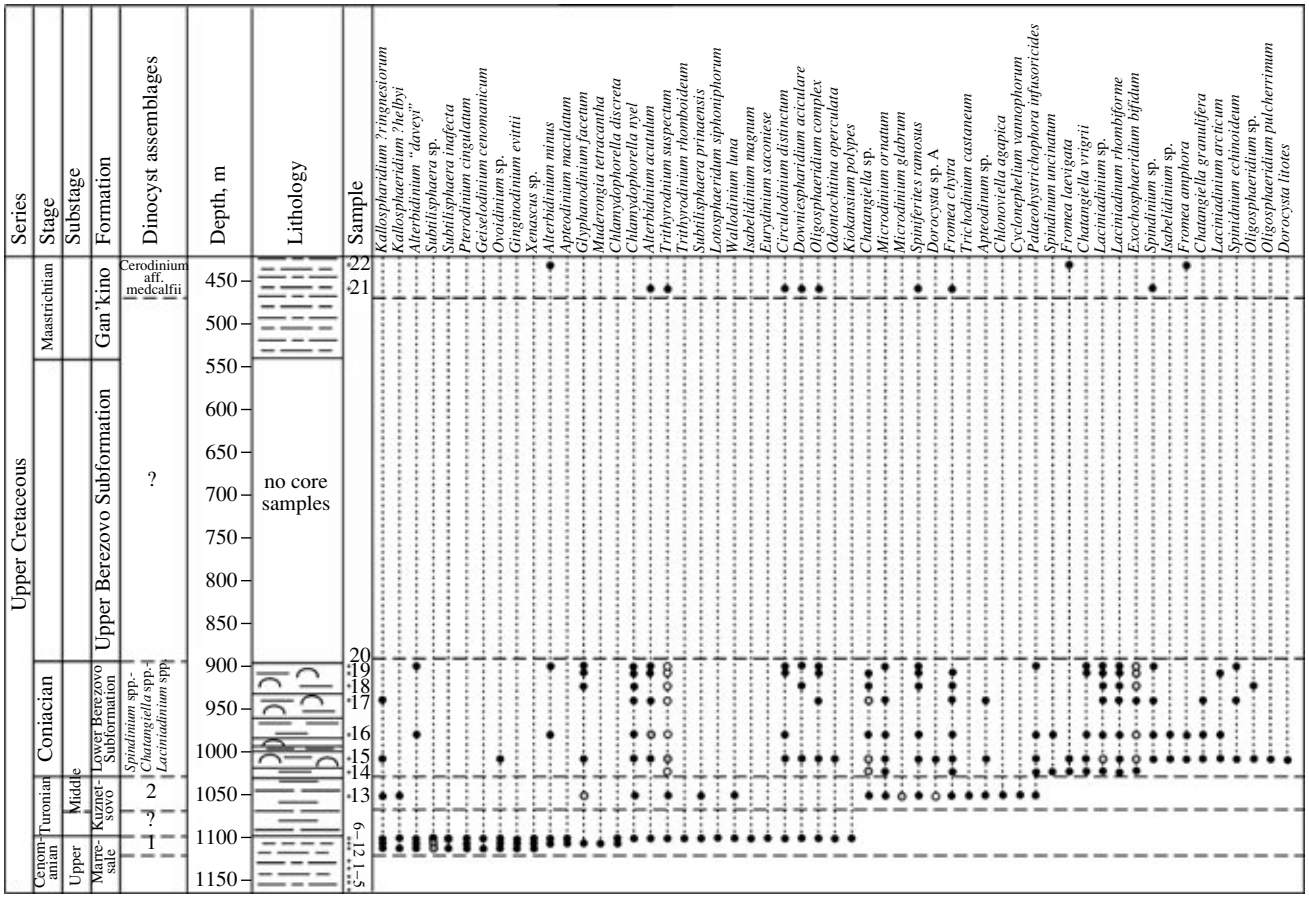


Fig. 4. Stratigraphic ranges of dinocysts in the Upper Cretaceous section of borehole Leningradskaya 1. Designations: (*1*) assemblage with *Eurydinium saxoniense* Marshall et Batten; (*2*) assemblage with *Dorocysta* sp. *A*; (Lower Berez.) Lower Berezovo Subformation; (Kuz.) Kuznetsovo (Mid.) Middle; (*Spiniferites ram.*) *Spiniferites ramosus*; for other designations, see Figs. 2 and 3.

Beds with *Chatangiella spectabilis–Heterosphaeridium difficile*

Characteristic assemblage. *Spiniferites* spp. prevails. *Dorocysta* sp. A, *Heterosphaeridium difficile, Chatangiella spectabilis, C. victoriensis, C. bondarenkoi, Ellipsoidinium rugulosum, Achomosphaera crassipellis, Elytrocysta circulata*, and others are typical.

Lower boundary is determined by the appearance of *Heterosphaeridium difficile, Florentinia buspina, F. ferox*, and others and by the increased diversity of members of *Chatangiella*.

Locality. Borehole Berezovskaya 23k, 164.6–149.3 m of depth, sample nos. 88–91.

The taxonomic composition of beds with *Rhiptocorys veligera–Oligosphaeridium poculum* from borehole Berezovskaya 23k is similar to that of borehole Yuzhno-Russkaya 113, which is dated Middle Turonian (Fig. 3). The characteristic combination of *Cyclonephelium vannophorum, Cauveridinium membraniphorum, Eurydinium* sp., *Alterbidinium "daveyi," Subtilisphaera pirnaensis*, and *Chatangiella tripartita* suggests a correlation between beds with *Chlamydophorella nyei–Chatangiella tripartita* and beds with *Chatangiella victoriensis* from the Middle Turonian section on the Chaika River. Beds with *Chatangiella spectabilis–Heterosphaeridium difficile* from borehole Berezovskaya 23k are reliably correlated with those of borehole Yuzhno-Russkaya 113 and, correspondingly, with beds with *Chatangiella spectabilis–Oligosphaeridium pulcherrimum* of the Ust'-Yenisei section (*In. (In.) lamarckii* and *Volviceramus inaequalis* zones, Middle–Upper Turonian) (Fig. 3). *Chatangiella bondarenkoi* appears in the upper portions of these beds. In general, the association of *Dorocysta* sp. *A, Chatangiella spectabilis*, and *C. bondarenkoi* is typical of beds with *Chatangiella bondarenkoi–Pierceites pentagonus* from the Yangoda River section (*Volviceramus inaequalis* Zone). A similar succession of dinocyst assemblages was found in borehole Yuzhno-Russkaya 113.

KARA SEA SHELF

Borehole Leningrandskaya 1 is situated on the Kara Sea shelf, 200 km northwest of the northern extremity of Belyi Island (Fig. 1) and exposes the Marresale, Kuznetsovo, Berezovo, and Gan'kino formations. Remains of microphytoplankton appear in sample 6

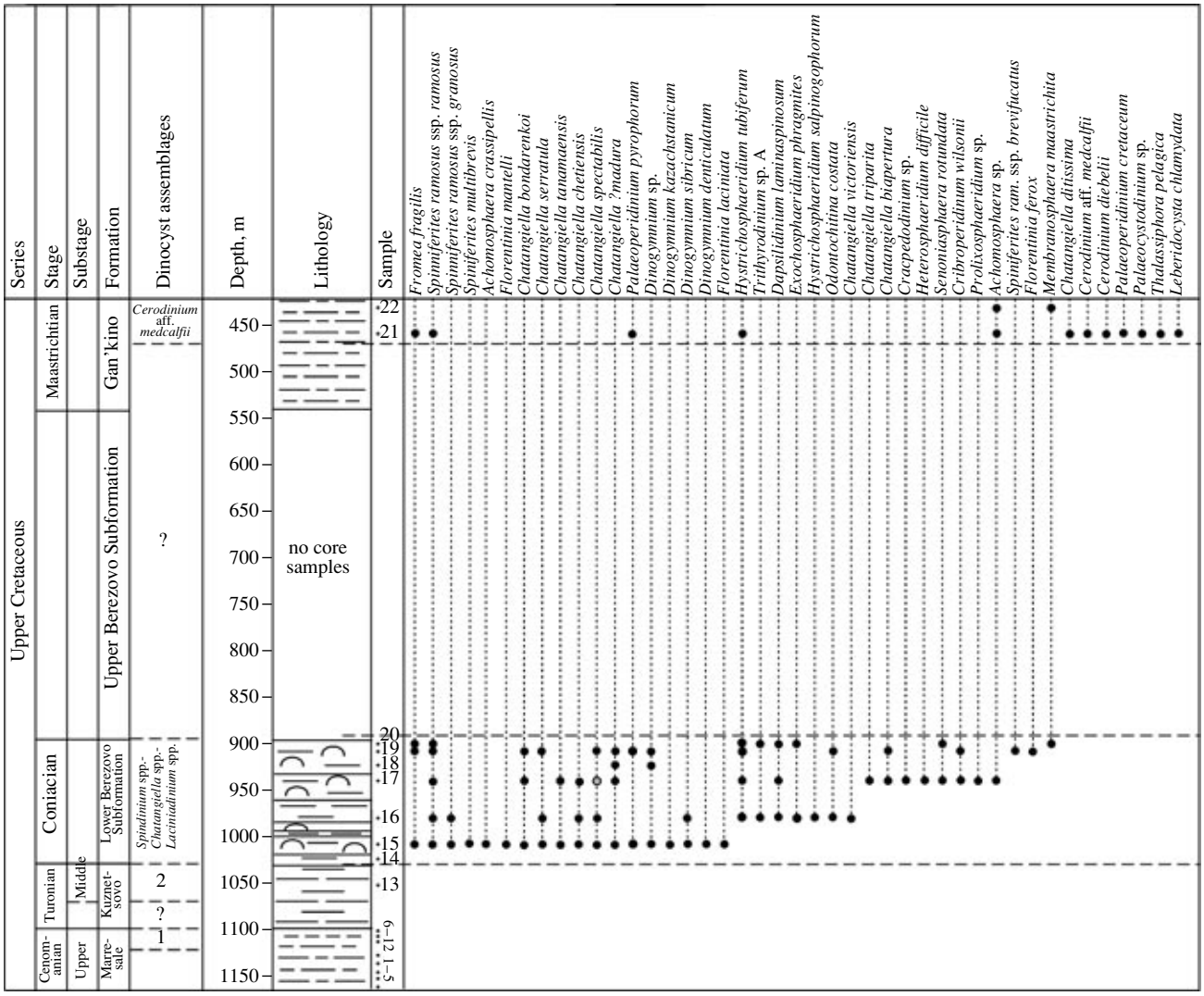


Fig. 4. (Contd.)

(Fig. 4). As the samples were collected from narrow disconnected intervals, it is impossible to establish dinocyst zones. Therefore, characteristics of the dinocyst assemblages given below describe one or several palynospectra.

Assemblage of *Eurydinium saxoniense* (Marresale Formation, 1107.3–1099.25 m of depth, sample nos. 6–12). The following taxa are found: *Alterbidinium "daveyi," A. minus, A. acutulum, Subtilisphaera* sp., *S. pirnaensis, Pterodininium cingulatum, Geiselodinium cenomanicum, Ginginodinium evittii, Xenascus* sp., *Apteodinium maculatum, Chlamydophorella discreta, C. nyei, Trithyrodinium rhomboideum, T. suspectum, Litosphaeridium siphoniphorum, Isabelidinium magnum, Euryidinium saxoniense, Oligosphaeridium complex*, and others.

Assemblage of *Dorocysta* sp. A (Kuznetsovo Formation, 1050 m of depth, sample no. 13). Some taxa persist from the interval described below. *Chatangiella* sp., *Microdinium glabrum, Microdinium ornatum, Dorocysta* sp. *A, Trichodinium castanea, Cyclonephelium vannophorum*, and others appear for the first time.

Assemblage of *Spinidinium* spp.–*Chatangiella* spp.–*Laciniadinium* spp. (Lower Berezovo Subformation, 1010–900 m of depth, sample nos. 14–20). Dominant is *Trithyrodinium suspectum.* Subdominants are *Chatangiella* spp. and *Exochosphaeridium bifidum. Spinidinium* spp., *Chatangiella vnigrii, C. granulifera, C. bondarenkoi, C. serratula, C. tanamaensis, C. chetiensis, C. spectabilis, C. madura, C. biapertura, C. tripartita, C. victoriensis, Laciniadinium* sp., *L. rhombiforme, L. arcticum, Oligosphaeridium pulcherrimum, Dorocysta litotes, Spiniferites ramosus* ssp. *granosus*, *S. ramosus* ssp. *ramosus*, *S. multibrevis, Achomosphaera crassipellis, Florentinia ferox, F. mantelii, F. laciniata, Dinogymnium* spp., *Hystrichosphaeridium tubiferum, Dapsilidinium laminaspinosum, Exochosphaeridium phragmites, Hystrichosphaeridium salpin-*

gophorum, Palaeoperidinium pyrophorum, Odontochitina costata, Heterosphaeridium difficile, Senoniasphaera rotundata, and other taxa are present.

Assemblage of *Cerodinium* aff. *medcalfii* (Gan'-kino Formation, 460–420 m of depth, sample nos. 21 and 22). *Chatangiella ditissima, Cerodinium diebelii, C.* aff. *medcalfii, Palaeoperidinium cretaceum, Palaeocystodinium* sp., *Thalassiphora pelagica,* and others appear.

POLAR FORE-URALS

During the field trips of 1999, researchers of the Institute of Petroleum and Gas Geology of the Siberian Division of the Russian Academy of Sciences studied natural outcrops of the Coniacian–Campanian age along the Seida and Usa rivers (Fig. 1). Detailed palynological and micropaleontological analyses of the section were accomplished; macrofaunal remains were also collected. Marinov et al. (2002) and Lebedeva (2005) published results of studies of belemnites, bivalves, foraminifers, and dinocysts.

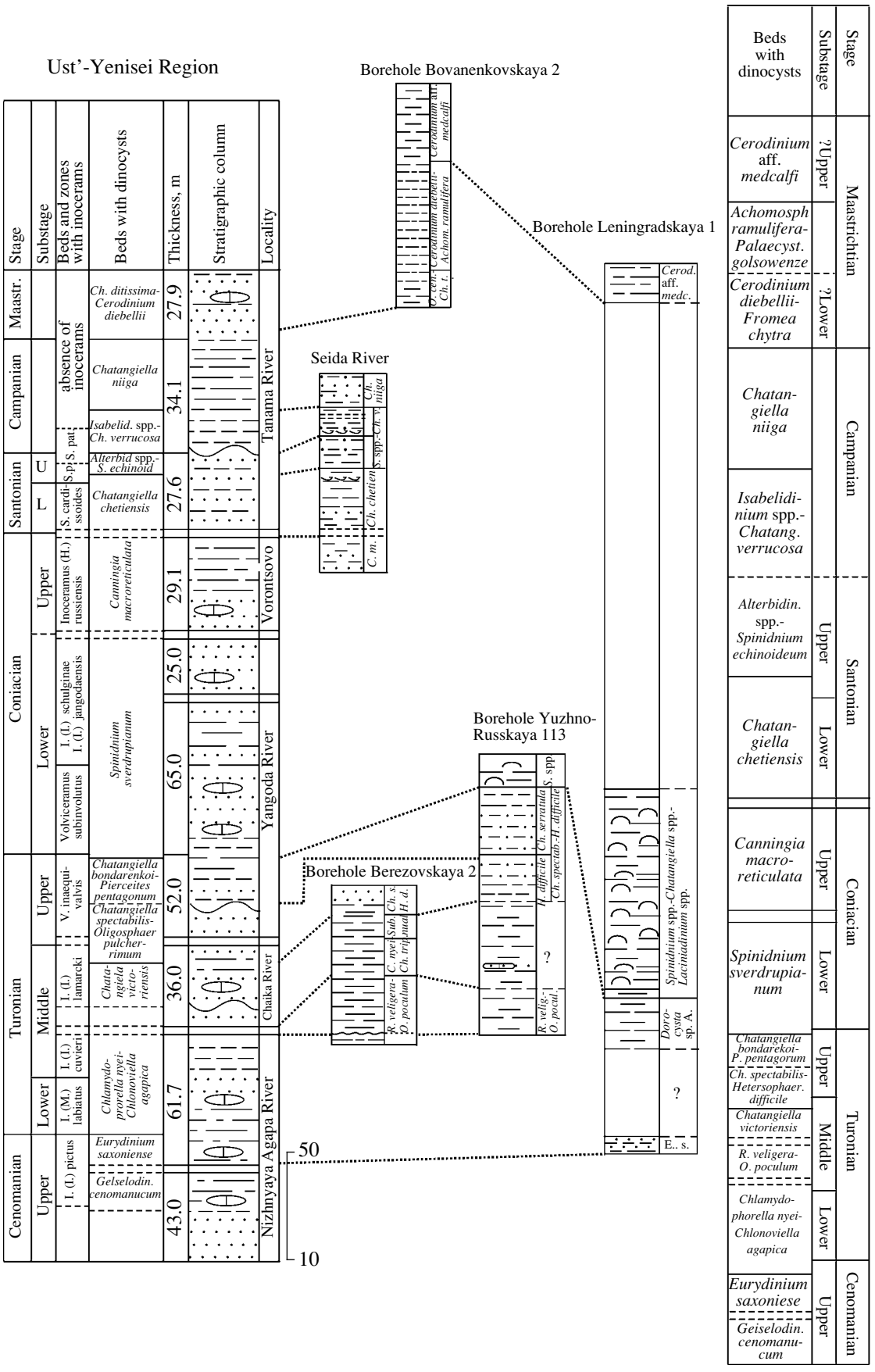
CORRELATION OF THE SECTIONS STUDIED AND DINOCYST ZONATION OF THE UPPER CRETACEOUS OF NORTHERN SIBERIA

The correlation of all the sections studied allowed the author to evaluate the content of some dinocyst biostratigraphic units, which were established in the reference Ust'-Yenisei section, to supplement them with missing units and, hence, to reconstruct the most complete succession of beds with dinocyst, which is proposed here as a standard dinocyst zonation of the Upper Cretaceous of northern Siberia (Fig. 5).

The earliest unit is *beds* with *Geiselodinium cenomanicum* of the Upper Cenomanian, which are only recorded in the Ust'-Yenisei Region. *Beds* with *Eurydinium saxoniense* are observed in borehole Leningradskaya 1. The assemblages are similar in the presence of *Eurydinium saxoniense, Geiselodinium cenomanicum, Litosphaeridium siphoniphorum, Pterodinium cingulatum, Ginginodinium evittii, Xenascus* sp., and *Isabelidinium magnum. Beds* with *Chlamydophorella nyei–Chlonoviella agapica* are only found in the Ust'-Yenisei Region. On the Chaika River, the section is continued by continental deposits, which are overlaid by marine deposits. The stratigraphic scope of the gap is apparently rather short, since the succession of inoceram zones is not broken; however, boundary deposits between the *Inoceramus (I.) cuvieri* and *I. (I.) lamarcki* zones in the marginal portion of the West Siberian Basin are missing in the section. *Beds* with *Chatangiella victoriensis* show significant changes: characteristic Cenomanian species disappear, and the stratigraphically important genus *Chatangiella* becomes a constant component of the assemblage. Boreholes Yuzhno-Russkaya 113 and Berezovskaya 23k contain a dinocyst assemblage that combines characteristic features of the assemblage from beds with *Chlamydophorella nyei–Chlonoviella agapica* (dominated by *Chlamydophorella nyei* and *Chlonoviella agapica* and including *Eurydinium saxoniense, Litosphaeridium* sp., *Isabelidinium magnum*, and *Cauveridinium membraniphorum*) with the appearance of isolated *Chatangiella*. Members of this genus become more numerous and diverse upward in the section. The data on appearance and disappearance of certain taxa in the succession of dinocyst assemblages of the Ust'-Yenisei section and above-mentioned boreholes suggest to place the beds with this assemblage between beds with *Chlamydophorella nyei–Chlonoviella agapica* and with *Chatangiella victoriensis* (Fig. 5). *Beds* with *Chatangiella victoriensis* is correlated with the beds with *Chlamydophorella nyei–Chatangiella tripartita* and with *Subtilisphaera hyalina* of borehole Berezovskaya 23k on the basis of co-occurrence of *Cyclonephelium vannophorum, Eurydinium* sp., *Alterbidinium "daveyi," Subtilisphaera pirnaensis,* and *Chatangiella tripartita. Beds* with *Chatangiella spectabilis–Oligosphaeridium pulcherrimum* (Ust'-Yenisei Region) were also recorded in boreholes Yuzhno-Russkaya 113 and Berezovskaya 23k. All the three assemblages are characterized by the first appearance of *Chatangiella spectabilis, C. tanamaensis*, and *C. biapertura* and the presence of *Dorocysta* sp. A. Dinocyst assemblages from these boreholes contain more diverse chorate dinocysts, including taxa that are important in terms of stratigraphy, such as *Surculosphaeridium longifurcatum* and *Heterosphaeridium difficile*. The appearance of the latter species is registered in the Upper Turonian in many regions of the Northern Hemisphere (Williams et al., 1993). *Oligosphaeridium pulcherrimum* occurs in borehole sections as isolated specimens, therefore, this stratigraphic unit is named beds with *Chatangiella spectabilis–Heterosphaeridium difficile* in the standard dinocyst zonation.

Analogues of beds with *Spinidinium sverdrupianum* were recorded in boreholes Yuzhno-Russkaya 113 and Leningradskaya 1. Early Coniacian assemblages are characterized by the increased number and diversity of *Spinidinium* and *Chatangiella*.

Beds with *Canningia macroreticulata* were found in the Ust'-Yenisei Region, the Polar Fore-Urals and Circumpolar Trans-Urals (Beizel' et al., 1996; Chlonova, 1996). *Canningia macroreticulata* is a supposed vicarious species of *Canningia reticulata,* which is a characteristic species of the Coniacian of northwestern Europe. The assemblage shows a combination of *Canningia macroreticulata, Dorocysta litotes*, and *Heterosphaeridium difficile*. The last species is abundant in the Coniacian–Lower Santonian of the North Sea (Costa and Davey, 1992). *Beds* with *Chatangiella chetiensis*, first found on the Tanama River (Ust'-Yenisei Region), are similar in their characteristic members to the unit with the same name in the section of the Polar Fore-Urals (Lebedeva, 2005). The genus *Chatangiella* dominates mostly due to *C. chetiensis, C. tanamaensis*, and *C. cassidea.*


Ust'-Yenisei Region
Borehole Bovanenkovskaya 2
Borehole Leningradskaya 1
Seida River
Borehole Yuzhno-Russkaya 113
Borehole Berezovskaya 2
Cenomanian
Turonian
Coniacian
Santonian
Campanian
Maastr.
Stage
Substage
Beds and zones with inocerams
Beds with dinocysts
Thickness, m
Stratigraphic column
Locality
Upper
Lower
Middle
Upper
Lower
Upper
L
U
absence of inocerams
I. (L.) pictus
I. (M.) labiatus
I. (L.) cuvieri
I. (L.) lamarcki
V. inaequivalvis
Volviceramus subinvolutus
I. (L.) schulginae
I. (L.) jangodaensis
Inoceramus (H.) russiensis
S. cardissoides
S. pat.
S. p.
Eurydinium saxoniense
Gelselodin. cenomanucum
Chlamydophorella nyei-Chlonoviella agapica
Chatangiella victoriensis
Chatangiella spectabilis-Oligosphaeridium pulcherrimum
Chatangiella bondarenkoi-Pierceites pentagonum
Spinidinium sverdrupianum
Canningia macroreticulata
Chatangiella chetiensis
Isabelid. spp.-Ch. verrucosa
Chatangiella niiga
Ch. ditissima-Cerodinium diebellii
43.0
61.7
36.0
52.0
65.0
25.0
29.1
27.6
34.1
27.9
Nizhnyaya Agapa River
Chaika River
Yangoda River
Vorontsovo
Tanama River
50
10
Beds with dinocysts
Stage
Substage
Maastrichtian
Campanian
Santonian
Coniacian
Turonian
Cenomanian
Cerodinium aff. medcalfi
Achomosph ramulifera-Palaecyst. golsowenze
Cerodinium diebellii-Fromea chytra
Chatangiella niiga
Isabelidinium spp.-Chatang. verrucosa
Alterbidin. spp.-Spinidnium echinoideum
Chatangiella chetiensis
Canningia macroreticulata
Spinidnium sverdrupianum
Chatangiella bondarekoi-P. pentagorum
Ch. spectabilis-Hetersophaer. difficile
Chatangiella victoriensis
R. veligera-O. poculum
Chlamydophorella nyei-Chlonoviella agapica
Eurydinium saxoniese
Geiselodin. cenomanucum

Deposits of the Santonian–Campanian boundary outcrop along the Tanama River (Ust'-Yenisei Region) and the Kheta River (Khatanga Region). The Santonian–Campanian boundary in the Tanama section is very distinct both lithologically and paleontologically (*Stratigraphy of Upper Cretaceous Deposits…*, 1986; Ilyina et al., 1994). This implies the presence of a stratigraphic gap, the scope of which was estimated only by detailed paleontological studies of the Kheta River section (Khomentovskii et al., 1999). Similar changes in the composition of dinocyst assemblages of these sections and the Polar Fore-Urals made it possible to accomplish a correlation between these distant sections (Lebedeva, 2005).

Beds with *Chatangiella ditissima–Cerodinium diebelii* of the Tanama River are most similar to beds with *Operculodinium centrocarpum–Chatangiella tripartita* (borehole Bovanenkovskaya 2). *Beds* with *Cerodinium diebelii–Achomosphaera ramulifera*, which continue the Maastrichtian succession of dinocyst biostratigraphic units, are recorded in borehole Bovanenkovskaya 2; and *beds* with *Cerodinium* aff. *medcalfii* are present in boreholes Bovanenkovskaya 2 and Leningradskaya 1.

Thus, the correlation of the sections studied reconstructed the most complete succession of biostratigraphic units (beds with particular dinocysts), which is possible to consider as a standard Upper Cretaceous zonation of northern Siberia until more data become available (Fig. 5).

STANDARD DINOCYST ZONATION OF THE UPPER CRETACEOUS OF NORTHERN SIBERIA

Beds with *Geiselodinium cenomanicum*

Characteristic assemblage. *Geiselodinium cenomanicum* and *Pervosphaeridium truncatum* are dominants. *Trithyrodinium rhomboideum, Trichodinium castanea, Ovoidinium scabrosum, Litosphaeridium siphoniphorum, Ginginodinium* sp., and *Pterodinium cingulatum* occur constantly. *Xenascus blastema, Pierceites pentagonus, Microdinium ?crinitum*, and *Cyclonephelium vannophorum* appear in the upper part.

Typical section is situated on the Nizhnyaya Agapa River, Members 2–4; thickness, 13 m.

Occurrence. Ust'-Yenisei Region.

Stratigraphic position. The lower part of the *Inoceramus pictus* Zone, Upper Cenomanian.

Beds with *Eurydinium saxoniense*

Characteristic assemblage. *Ginginodinium evittii, Odontochitina operculata, Xenascus blastema*, and ?*Amphidiadema* sp. *A. dominate*. *Eurydinium saxoniense, Canningia rotundata*, and *Isabelidinium magnum* occur constantly. *Microdinium distinctum* appears in the upper part.

Boundaries. The lower boundary is determined by the appearance of *Eurydinium saxoniense, ?Amphidiadema* sp. *A, Microdinium ornatum,* and *Alterbidinium minus.*

Typical section is situated on the Nizhnyaya Agapa River, Members 7–9; thickness, 14.5 m.

Occurrence. Ust'-Yenisei Region and the Kara Sea shelf.

Stratigraphical position. The upper part of the *Inoceramus pictus* Zone, Upper Cenomanian.

Beds with *Chlamydophorella nyei–Chlonoviella agapica*

Characteristic assemblage. Dominants are *Chlamydophorella nyei, Chlonoviella agapica*, and *Glyphanodinium facetum. Alterbidinium "daveyi," Isabelidinium magnum, Microdinium glabrum, Cauveridinium membraniphorum, Rhiptocorys veligera, Eurydinium saxoniense*, and *Kallosphaeridium ?circulare* are constantly present.

Boundaries. The lower boundary is determined by the appearance of *Dorocysta* sp. *A, Microdinium glabrum*, and *Cauveridinium membraniphorum* and the disappearance of *Litosphaeridium siphoniphorum, Geiselodinium cenomanicum*, and *?Amphidiadema* sp. *A*.

Typical section is situated on the Nizhnyaya Agapa River, Members 10–15; thickness, 47 m.

Occurrence. Ust'-Yenisei Region.

Stratigraphic position. The upper part of the *Inoceramus pictus* Zone, Upper Cenomanian, *Inoceramus (Mytiloides) labiatus* Zone, Lower Turonian, *Inoceramus (Inoceramus)* cf. *cuvieri*, Upper Turonian.

Fig. 5. Correlation of the main sections and the standard succession of beds with dinocysts for the Upper Cretaceous of northern Siberia. Designations: (Maastr.) Maastrichtian; (U) Upper; (L) Lower; (*Ch.*) *Chatangiella*; (*Isabelid.*) *Isabelidinium*; (*Alterbid.*) *Alterbidinium*; (*S. echinoid.*) *Spinidinium echinoideum*; (*S. cardissoides*) *Sphenoceramus cardissoides*; (*I.*) *Inoceramus*; (*V.*) *Volviceramus;* (*M.*) *Mytiloceramus*; (*H.*) *Haenleinia*; (*Oligosphaer., O.*) *Oligosphaeridium*; (*Geiselodin.*) *Geiselodinium*; (*R. veligera, R. velig.*) *Rhiptocorys veligera*; (*O. pocul.*) *Oligosphaeridium poculum*; (*Sub. hyal.*) *Subtilisphaera hyalina*; (*Ch. s., Ch. spectab.*) *Chatangiella spectabilis*, (*H. d., H. difficile*) *Heterosphaeridium difficile*, (*S.* spp.) *Spinidinium* spp.; (*E.s.*) *Eurydinium saxoniense*; (*C. m.*) *Canningia macroreticulata;* (*Ch. chetien.*) *Chatangiella chetiensis*; (*Ch. v.*) *Chatangiella victoriensis;* (*Ch. t.*) *Chatangiella tripartita*; (*Cerod.* aff. *medcalfii*) *Cerodinium* aff. *medcalfii;* (*O. cen.*) *Operculodinium centrocarpum*, and (*Achom. Ramulifera*) *Achomosphaera ramulifera*; for other designations, see Figs. 2, 3, and 4.

Beds with *Rhiptocorys veligera–Oligosphaeridium poculum*

Characteristic assemblage. *Chlonoviella agapica, Rhiptocorys veligera, Microdinium* spp., *Chlamydophorella discreta*, and *C. nyei* dominate. *Eurydinium saxoniense, Alterbidinium "daveyi,"* and *Trithyrodinium suspectum* are common. *Pterodinium cingulatum, Cyclonephelium vannophorum, Circulodinium densebarbatum, Oligosphaeridium albertense, O. poculum*, and *Chatangiella tripartita* are accompanying elements.

Boundaries. The lower boundary is determined by the first appearance of *Chatangiella tripartita* and by the last appearance of *Oligosphaeridium albertense* and *O. poculum.*

Typical section is situated in the borehole Berezovskaya 23k, 220–197 m of depth.

Stratigraphic position. Presumably Middle Turonian.

Beds with *Chatangiella victoriensis*

Characteristic assemblage includes *Chatangiella victoriensis, Cauveridinium membraniphorum, Cyclonephelium vannophorum, Kallosphaeridium ?ringnesiorum, Subtilisphaera pirnaensis, Laciniadinium* sp., *Eurydinium* sp., and *Chichaouadinium* cf. *vestitum*.

Boundaries. The lower boundary is indicated by the appearance of *Chatangiella* victoriensis, and *Chichaouadinium* cf. *vestitum* and the disappearance of *Isabelidinium magnum* and *Eurydinium saxoniense.*

Typical section is situated along the Chaika River, Members 1–2; thickness, 20 m.

Occurrence. Ust'-Yenisei Region, borehole Berezovskaya 23k.

Stratigraphic position. The lower part of the *Inoceramus (Inoceramus) lamarki* Zone, Upper Turonian.

Beds with *Chatangiella spectabilis–Heterosphaeridium difficile*

Characteristic assemblage includes *Dorocysta* sp. *A, Cribroperidinium exilicristatum, Surculosphaeridium longifurcatum, Apteodinium maculatum, Cyclonephelium vannophorum, Ginginodinium evittii, Chatangiella spectabilis, C. biapertura*, and *Microdinium distinctum.* In the upper portion of this local zone, *Oligosphaeridium pulcherrimum* appears.

Boundaries. The lower boundary is determined by the appearance of *Chatangiella spectabilis, C. tripartita, C. vnigrii, C. granulifera, C. tanamaensis*, and *C. biapertura* and the disappearance of *Trithyrodinium rhomboideum* and *Cauveridinium membraniphorum.*

Typical section is situated on the Chaika River, Members 3–7, Yangoda River, Members 1–2; thickness, 17 m.

Stratigraphic position. The upper part of the *Inoceramus* (Inoceramus) *lamarki* Zone and the lower part of the *Volviceramus inaequivalvis* Zone, Upper Turonian.

Beds with *Chatangiella bondarenkoi–Pierceites pentagonus*

Characteristic assemblage: includes *Chatangiella bondarenkoi, C. serratula, C. granulifera, C. madura, C. spectabilis, Heterosphaeridium difficile, Dorocysta* sp. *A, Pierceites pentagonus, Subtilisphaera pirnaensis*, and *Cyclonephelium vannophorum.*

Boundaries. The lower boundary is marked by the appearance of *Chatangiella bondarenkoi, C. serratula*, and *C. chetiensis.*

Typical section is situated on the Yangoda River, Members 3–8 (partly); thickness, 37 m.

Occurrence. Ust'-Yenisei Region, borehole Yuzhno-Russkaya 113.

Stratigraphic position. A part of the *Volviceramus inaequivalvis* Zone, Upper Turonian.

Beds with *Spinidinium sverdrupianum*

Characteristic assemlblage includes *Spinidinium sverdrupianum, S. ornatum, Magallanesium balmei, Oligosphaeridium complex, Chatangiella serratula, C. vnigrii, C. chetiensis, C. granulifera, Pierceites pentagonus, Eisenackia* sp., and *Exochosphaeridium bifidum.*

Boundaries. The lower boundary is marked by the appearance of *Spinidinium sverdrupianum, S. ornatum, Magallanesium balmei*, and *Chatangiella cassidea.*

Typical section is situated on the Yangoda River, upper part of Members 8–19; thickness, 61 m.

Occurrence. Ust'-Yenisei Region, western Siberia, Kara Sea shelf.

Stratigraphic position. The middle part of the *Volviceramus inaequivalvis* Zone, Upper Turonian, *Volviceramus subinvolutus* Zone, and the beds with *Inoceramus schulginae–I. jangodaensis*, Lower Coniacian.

Beds with *Canningia macroreticulata*

Characteristic assemblage includes *Canningia macroreticulata, Alterbidinium minus, Senoniasphaera protrusa, Subtilisphaera pirnaensis*, and *Odontochitina operculata.*

Boundaries. The lower boundary is indicated by the appearance of *Canningia macroreticulata* and *Senoniasphaera protrusa* and by the disappearance of *Pierceites pentagonus* and *Dorocysta* sp. *A*.

Typical section is situated on the Yangoda River, Members 21–25; thickness, 20.1 m, village of Vorontsovo, Members 1–8; thickness, 29.1 m.

Occurrence. Ust'-Yenisei Region, Circumpolar Urals, Polar Fore-Urals.

Stratigraphic position. *Inoceramus russiensis* Zone, Upper Coniacian.

Beds with *Chatangiella chetiensis*

Characteristic assemblage. Dominants are *Chatangiella chetiensis, C. tanamaensis, C. cassidea, C.* sp. *A*; and *Trithyrodinium suspectum. Spinidinium uncinatum, S. echinoideum, Chatangiella bondarenkoi, C. granulifera, C. verrucosa, C. madura*, and *Isabelidinium rectangulatum* are present.

Boundaries. The lower boundary is determined by the appearance of *Chatangiella verrucosa, C. ditissima*, and *Isabelidinium rectangulatum* and by the disappearance of *Canningia macroreticulata* and others.

Typical section is situated on the Tanama River, Members 1–2; thickness, 11.7 m.

Occurrence. Ust'-Yenisei and Khatanga regions and the Polar Fore-Urals.

Stratigraphic position. *Sphenoceramus cardissoides* Zone, Lower Santonian, lower part of the *Sphenoceramus patootensis* Zone, Upper Santonian.

Beds with *Alterbidinium* spp.–*Spinidinium echinoideum*

Characteristic assemblage. *Alterbidinium* spp., *Spinidinium echinoideum, Trithyrodinium suspectum*, and *Fibrocysta* sp. dominate. *Alterbidinium "daveyi," A. acutulum, Chatangiella chetiensis, C. tanamaensis, C. madura, C. ditissima, Microdinium ornatum, M. kustanaicum*, and *Laciniadinium rhombiforme* occur.

Boundaries. The lower boundary is marked by the appearance of *Laciniadinium rhombiforme*, disappearance of *Chatangiella cassidea* and *N. victoriensis*, and the decreasing number of *Chatangiella*.

Typical section is situated on the Tanama River, Member 3; thickness, 15.7 m, Kheta River, upper part of Members 1–3; thickness, 11.3 m.

Occurrence. Ust'-Yenisei and Khatanga regions.

Stratigraphic position. The upper part of the *Sphenoceramus patootensis* Zone, a part of the *Sphenoceramus patootensiformis* Zone, Upper Santonian.

Beds with *Isabelidinium* spp.–*Chatangiella verrucosa*

Characteristic assemblage. *Trithyrodinium suspectum, Chatangiella vnigrii, Isabelidinium amphiatum, I. belfastense, I. bakeri, I. nooksoniae, I. microarmum*, and *Laciniadinium rhombiforme* dominate. *Chatangiella verrucosa, C. ditissima, C. niiga, C. micracantha, C. manumii,* and *Laciniadinium arcticum* are present.

Boundaries. The lower boundary is defined by the appearance of *Chatangiella niiga, C. micracantha, C. manumii*, and *Isabelidinium belfastense* and the disappearance of *Rhyptocorys veligera* and *Chatangiella* sp. *A*.

Typical section is situated on the Tanama River, Members 4 and 5; thickness, 12.5 m; and the Kheta River, Members 4 and 5; thickness, 23.1 m.

Occurrence. Ust'-Yenisei and Khatanga regions, the Polar Fore-Urals.

Stratigraphic position. The upper part of the *Sphenoceramus patootensiformis* Zone, ?Campanian.

Beds with *Chatangiella niiga*

Characteristic assemblage. *Laciniadinium arcticum, L. rhombiforme, Chatangiella niiga, C. manumii*, and *C. spinata* are dominants. *Dinogymnium* spp., *Laciniadinium williamsii, Fibrocysta* sp., *Tanyosphaeridium* sp., *Prolixosphaeridium* sp., *Operculodinium centrocarpum, Chatangiella madura*, and *Isabelidinium* spp. are present.

Boundaries. The lower boundary is marked by the appearance of *Chatangiella spinata*, a sharply increased number of spinate members of *Chatangiela*, and by the disappearance of *Chatangiella verrucosa, C. vnigrii, C. spectabilis, C. granulifera, C. tripartita, Chlonoviella agapica*, and *Alterbidinium "daveyi."*

Typical section is situated on the Tanama River, Members 6 and 7; thickness, 21.6 m; Kheta River, Members 6–9; thickness, 22 m.

Occurrence. Ust'-Yenisei and Khatanga regions and the Polar Fore-Urals.

Stratigraphic position. Campanian.

Beds with *Nerodinium diebelii–Fromea chytra*

Characteristic assemblage includes *Cerodinium diebelii, Fibrocysta axialis, Operculodinium centrocarpum, Chatangiella ditissima, Membranosphaera maastrichtica, Laciniadinium arcticum, Alterbidinium minus, A. acutulum*, and *Chlonoviella agapica.* Members of the genus *Fromea* (*Fromea chytra, F. laevigata*, and *F. fragilis*) are most numerous and most diverse.

Boundaries. The lower boundary is marked by the appearance of *Nerodinium diebelii a*nd *Fibrocysta axialis a*nd decreasing diversity of *Chatangiella*.

Typical section is situated on the Tanama River, Members 8–12; thickness, 22.7 m.

Occurrence. Ust'-Yenisei Region, borehole Bovanenkovskaya 2.

Stratigraphic position. Maastrichtian.

Beds with *Achomosphaera ramulifera–Palaeocystodinium golzowense*

Characteristic assemblage includes *Cerodinium diebelii* and *Achomosphaera ramulifera* with scarce *Chatangiella granulifera, Isabelidinium* sp., *Glyphanodinium facetum, Rhyptocorys veligera, Palaeoperidinium pyrophorum, Spinidinium* sp., *Palaeocystodinium golzowense, Deflandrea* sp., and *Areoligera* sp.

Boundaries. The lower boundary is marked by the disappearance of *Chatangiella tripartita* and *Chlonoviella*.

Locality. Borehole Bovanenkovskaya 2, sample nos. 74–87; thickness, 48 m.

Occurrence. Borehole Bovanenkovskaya 2.

Stratigraphic position. Maastrichtian.

Beds with *Cerodinium* aff. *medcalfii*

Characteristic assemblage includes *Cerodinium* aff. *medcalfii*, numerous *Laciniadinium firmum, Glyphanodinium facetum, Fromea chytra*, and *Spiniferites ramosus* ssp. *ramosus*, and rare *Laciniadinium williamsii, Palaeotetradinium silicorum, Palaeocystodinium golzowense, Wallodinium luna*, and *Gillinia hymenophora.*

Boundaries. The lower boundary is determined by the appearance of the index species and disappearance of *Chatangiella*.

Locality. Borehole Bovanenkovskaya 2, sample nos. 88–95; visible thickness, 32 m.

Stratigraphic position. The middle Upper Maastrichtian.

CONCLUSIONS

The successful correlation of distant Upper Cretaceous deposits on the basis of dinocysts is complicated by their extraordinary diversity, asynchronous appearance and disappearance of particular taxa in different regions, and provincialism. The panboreal correlation of dinocyst assemblages of northern Siberia, northwestern Europe, Arctic and East Canada, and Atlantic coast of the United States was accomplished (Ilyina et al., 1994; Zakharov et al., 2002; Lebedeva, 2005). Two correlative levels were revealed. The first is in the Cenomanian, distinguished by the occurrence of *Litosphaeridium siphoniphorum*, while the second is in the Middle Santonian, marked by the appearance of the characteristic species *Spinidinium echinoideum.* The Late Turonian–Early Coniacian dinocyst assemblages of the Ust'-Yenisei Region and eastern Canada are similar in the presence of some species of *Chatangiella* and *Florentinia ferox, Oligosphaeridium pulcherrimum, Magallanesium balmei, Senoniasphaera protrusa, Subtilisphaera pirnaensis*, and others. The Santonian–Maastrichtian assemblages of northern Siberia and Arctic Canada are very comparable. On the basis of dinocysts, three correlative levels of Upper Cretaceous deposits have been recognized in the sections of northern Siberia and New Jersey (Atlantic coast of the United States). The first level is in the Cenomanian, marked by the appearance of *Trithyrodinium suspectum*; the second is in the Santonian, indicated by the increased number of *Chatangiella*. The appearance of *Chatangiella manumii* and *C. vnigrii* is very characteristic in the Campanian of the regions compared. Vasil'eva (2005) revealed in the Kushmurun section (northern Kazakhstan) the beds with *Chatangiella manumii*, which was dated Late Campanian based on the presence of *Placenticeras meeki* (Boehm.). The assemblage is dominated by *Chatangiella manumii, Spinidinium uncinatum, S. echinoideum, Alterbidinium "daveyi," A. minus*, and *A. acutulum.*

Thus, the Upper Cretaceous deposits are subdivided on the basis of dinocyst data in the reference sections of the Ust'-Yenisei and Khatanga regions and the Polar Fore-Urals and in core samples from western Siberia and the Kara Sea shelf. For the first time, the correlation of the sections studied provides a reconstruction of complete succession of dinocyst assemblages and a standard dinocyst zonation for the Upper Cretaceous of northern Siberia, with 15 biostratigraphic units (beds with characteristic assemblages) from the Upper Cenomanian to Maastrichtian, which is correlated to the inoceram zonation.

LIST OF DINOCYST SPECIES AND GENERA

The nomenclature follows *The Lentin and Williams Index of Fossil Dinoflagellages* (Fensome and Williams, 2004). Asterisks mark the taxa the names of which are retained in the former variants, since their systematic position is questionable, and treated differently by different authors.

Achomosphaera crassipellis (Deflandre et Cookson) Stover et Evitt, 1978

Achomosphaera ramulifera (Deflandre) Evitt, 1963

Alterbidinium acutulum (Wilson) Lentin et Williams, 1985

**Alterbidinium "daveyi"* (Stover et Evitt) Lentin et Williams, 1985

Alterbidinium minus (Alberti) Lentin et Williams, 1985

Apteodinium maculatum Eisenack et Cookson, 1960

Canningia macroreticulata Lebedeva in Ilyina et al., 1994

Cauveridinium membraniphorum (Cookson et Eisenack) Masure in Fauconnier and Masure, 2004

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