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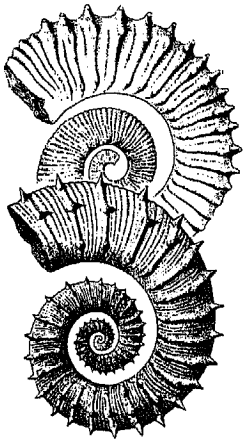
Jost Wiedmann Memorial Volume

NEW DEVELOPMENTS IN CRETACEOUS RESEARCH TOPICS



Proceedings of the 4th INTERNATIONAL CRETACEOUS SYMPOSIUM, Hamburg 1992

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Albian-Cenomanian correlations in NE Russia

ALEXEY ALABUSHEV*)

Abstract

Six Albian to Cenomanian ammonite Zones are assigned in north-eastern Russia. All biostratigraphic units are characterized by the presence of numerous endemic and rare cosmopolitan forms. There is a distinct hiatus of sedimentation, which corresponded to the lowermost part of the Upper Albian (except Sakhalin). The recognized marker of the Albian/Cenomanian boundary is the appearance of *Eogunnarites alaskensis* MAT., *E. unicus* MAT., *Desmoceras (Pseudouhligella) japonicum* MAT., and *Parajaubertella kawakitani* MAT. It is suggested that the Pseudhelicoceras carlottense Subzone can be located within the lower part (Upper Albian) of Rapidoplacenticeras sutherlandbrowni - Marshallites cumshewaensis Zone, as well as the Hypoturrilites gravesianus Subzone - within the upper part (Lower Cenomanian) of this zone.

The Middle Cenomanian forms provide a biogeographic link between West European and Far Eastern faunas, indicating that faunal interchange between the North Atlantic and North Pacific Oceans was possible.

Introduction

Marine terrigenous strata of Albian to Turonian age are well known from north-eastern Russia at the present time. They are widely distributed along the north-western periphery of the Pacific between the volcano-plutonic belt and the system of island arcs (Fig. 1). There are three different regions, which are characterized by specific features of the Albian-Cenomanian cross-sections. The first, the Koryak region (Main Valley, Main's Mountains, etc.), is marked by tectonically disturbed, poorly fossiliferous and discontinuous strata of Albian-Turonian age. The second region is the Southern Sakhalin, where a good sequence of well studied Cretaceous rocks is characterized by thick strata with poor fossil complexes, being generally endemic. Contrary to these two regions, the north-western Kamchatka (Penzhina and Ainyn areas) displays well exposed strata and well preserved endemic and cosmopolitan fossils.

The Ainyn Valley is characterized by fairly good stratigraphic sequences from Albian to Turonian stages (VERESCHAGIN, 1977). This region could be used as a reference section for the interpretation of the Albian-Turonian stratigraphy and geological history of the North-Western Pacific.

The sections of Albian-Cenomanian rocks in Southern Sakhalin, North-Western Kamchatka and the Koryak region were studied by the author during 1984–1989. The visited sections are consisting of two series of strata (Fig. 2). The first is characterized by a great quantity of conglomerates and psammitic tuffites.

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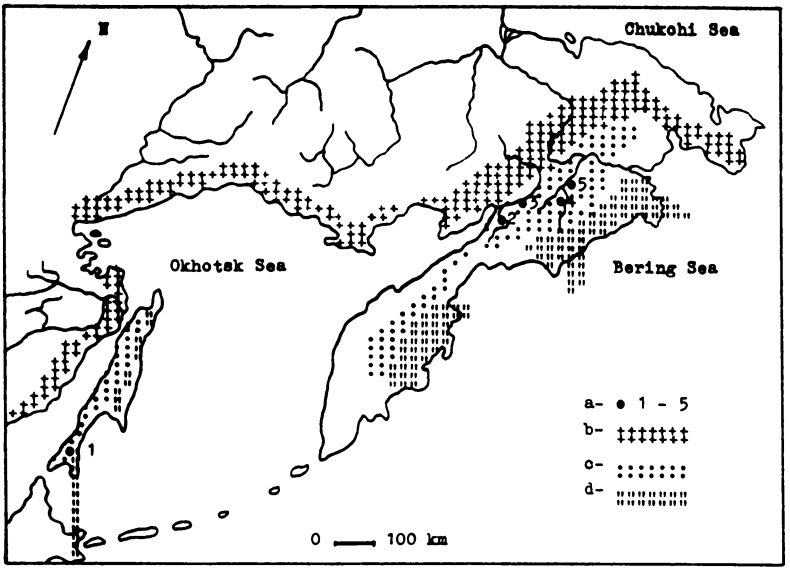

Fig. 1: Map of North-Eastern Russia showing areas visited during 1984-1989.
Legend: a - locations of studied sections: 1 - Naiba area, 2 - Ainyn area, 3 - Penzhina area, 4 - Main valley, 5 - Main's Mountains; b - Okhotsk-Chukchi Volcanic Belt; c - Miogeosynclinal Depression; d - System of Island Arcs.

The second sedimentary series is distinguished by interbedded sandstones and siltstones. Everywhere, except Sakhalin, the boundary between these two series of strata was marked by transgressive overlap of basal thick bedded conglomerates.

Upper Albian to Cenomanian intervals of studied sections are continuous in all areas except Main's Mountains. The base is covered and was probably faulted here.

Two distinct lithofacies are dominant within informal units. The first of these is a thick bedded conglomerate lithofacies, typically containing numerous horizons of conglomerates with pebbles of all sorts and interbedded sandstones, grit or blocks. The second dominant lithofacies consists of rhythmically interbedded sandstones and siltstones with concretionary limestone horizons.

Biostratigraphic and taxonomic studies

A detailed report concerning early geological investigations of Cretaceous strata in North-Eastern Russia is given by VERESCHAGIN (1977). The fossils, which were collected by early geologists, were described and discussed in several monographs and short taxonomic papers (AVDEIKO, 1968; PERGAMENT, 1978; POKHIALAYNEN, 1985; POYARKOVA [editor-in-chief], 1987; TEREKHOVA, 1969; etc.). All results of these studies were reflected in local and regional stratigraphic schemes, in which endemic species and genera are used as indexes for stratigraphic units. This leads to a different understanding of volume and age of

taxa and allocations according to their stratigraphic subdivisions. New paleontological discoveries and revision of older materials allow for a detailed biostratigraphic scale and contribute to the understanding of the evolution of ammonites.

Sakhalin (Naiba area)

The rocks which are assigned to the Aiskaya Formation (Fig. 2) are Albian by their stratigraphic position and occurrence of *Inoceramus anglicus* WOODS. The base is covered at this site. Layers with "*Cleoniceras* sp." (Fig. 3) correspond to Upper Albian and Lower Cenomanian. Index-species belong to *Rapidoplacenticeras sutherlandbrowni* (MCLEARN), which is well known from the Koryak-Kamchatka region (ALABUSHEV, 1989), Pacific coast of USA (MATSUMOTO; 1959) and Canada (MCLEARN, 1972). Besides, *Inoceramus dunveganensis aiensis*, typical for the lower part of the Naibinskaya Formation, was discovered by the author in Lower Cenomanian of the Main area (Grebyonka Valley), together with *Mariella (M.) cenomanensis* (SCHLÜT). The occurrence of *Parajaubertella kawakitana* MATSUMOTO in the Second Member of the Naibinskaya Formation also indicates a Cenomanian age of the rocks. Foraminiferal complexes of these strata contain *Hedbergella simplicissima* MAGNE et SAGAL, *Gavelinella cenomanica* BROTZ., *Praeglobotruncana delrioensis* PLUMMER, *Gaudryina irenensis* STELCK et WALL, *Trochammina rainwateri* CUSHMAN et APPLIN, *Siphotextularia rayi* TAPPAN (personal communication by A. V. ALABUSHEVA), to corroborate this conclusion. The position of the Albian/Cenomanian boundary can not be de-

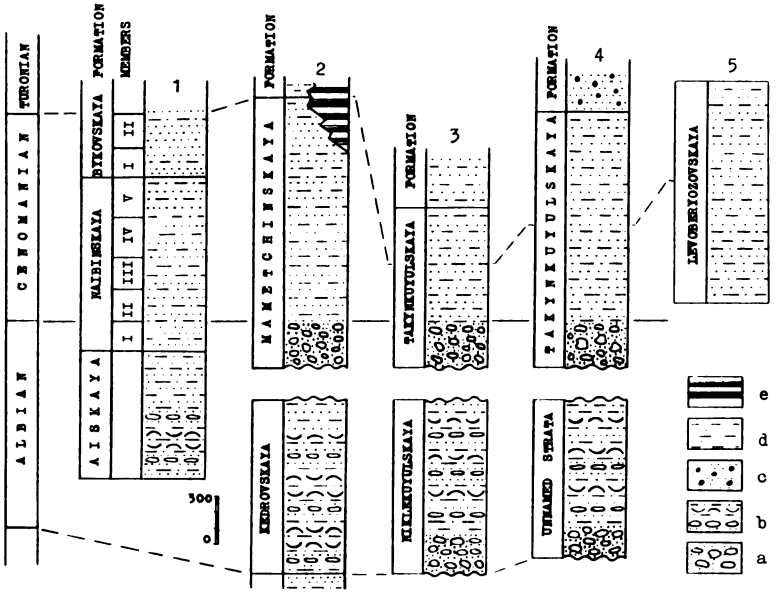

Fig. 2: Correlation of the lithostratigraphic units. 1 – 5 – studied sections according to fig. 1. a – e – lithofacies: a – thick bedded conglomerate lithofacies, b – interbedded sandstone-conglomerate-tuffite lithofacies, c – pebbly sandstone lithofacies, d – interbedded sandstone-siltstone lithofacies, e – continental deposits of the Valizhgenskaya Formation.

fined with confidence. One can show, more or less definitely, the Albian age of the Aiskaya Formation and the Cenomanian age of the Second Member of the Naibinskaya Formation. The poor finds of *Turrilites costatus* LAMARCK; *Acanthoceras sussexiense* MANTELL, *Mikasaites orbicularis* MATSUMOTO and *Marshallites olcostephanoides* MATSUMOTO from Members IV-V of Naibinskaya and Members I-II of Bykovskaya Formations indicate a Cenomanian age of the rocks.

The upper part of section contains numerous *Gaudryceras tenuiliratum* YABE (s. l.), which indicate a Turonian age.

Koryak-Kamchatka Region

The rocks of Kedrovskaya Formation in North-Western Kamchatka are Albian. There is an uninterrupted sequence of sediments from the Aptian to the Albian. In two other studied areas interruptions in the deposition are apparent. Nevertheless, the base of Niklekuyulskaya Formation in the Penzhina area and of the Unnamed Strata in the Main Valley correspond to Lower Albian (Fig. 2). There are some interesting features of sedimentation during Late Albian and Early Cenomanian. For example, one can observe blocks and boulders of Valanginian to Albian rocks within the basal part of the Upper Albian strata in the Main Valley and at Bering's Peninsula. Moreover, there is redeposition of concretions with the Albian fauna. Another feature is a great quantity of concretionary limestones, and above them thinbedded tuffites in the centre of the Koryak region.

Six ammonite faunas and zones can be recognized within the Albian and Cenomanian strata. Some of these zones were early established by other authors (VERESCHAGIN, 1977; TEREKHOVA, 1979; etc.). Relationship of these view points

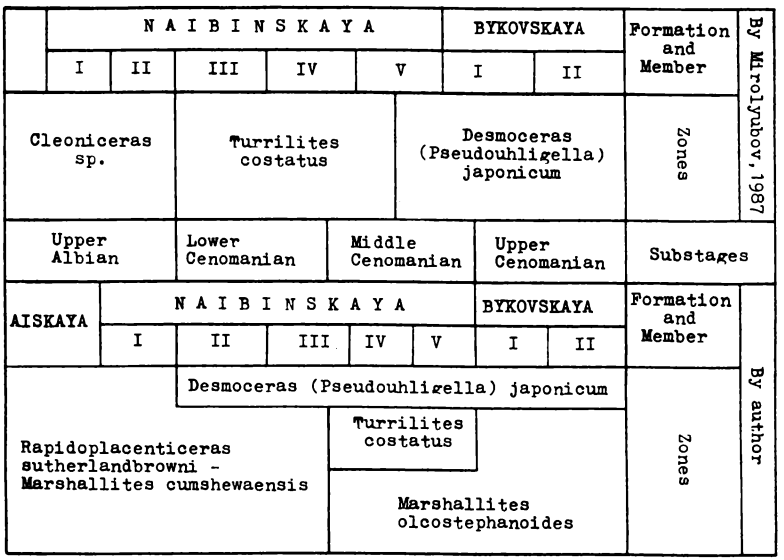

Fig. 3: Correlation of the litho- and biostratigraphic units of Southern Sakhalin.

concerning age, volume of layers, and zones was earlier described and discussed by the author (ALABUSHEV, 1989). Therefore, only a short description of the faunas and zones is suggested below.

Leconteites deansi Zone is regocgnized by the zonal index, *L. deansi* (WHITEAVES) (Fig. 4, A), and *Kennicottia bifurcata* IMLAY, *Moffitites robustus* IMLAY, *Kossmatella cappsi* IMLAY; *Anagaudryceras aurarium* (ANDERSON), and rare *Grantziceras affine* (WHIT.). The presence of the *Leconteites deansi* fauna was established at the Pacific coast of USA and Canada (IMLAY, 1960; JONES, MURPHY, PACKARD, 1965; JONES, 1967; and JELETZKY, 1977) below strata with the *Brewericeras hulenense – Douvilleiceras mammillatum* fauna. In California the uppermost Aptian Acanthoplites reesidei Zone is overlapped by strata with *L. deansi* fauna (ANDERSON, 1938; JELETZKY, 1977).

Freboldiceras singulare Zone. Associated with rare *Freboldiceras singulare* IMLAY (Fig. 4, B, C) in the studied sections are *Grycia dubia* (I. MICH. et TER.), *Grantziceras affine* (WHIT.) and, in the upper part of the zone, *Parasilesites laperousianus* (WHIT.). Few specimens of *F. singulare* are found in Main Valley from strata with *Brewericeras hulenense* (AND.). But well preserved examples of *F. singulare* were described in Spitsbergen (NAGY, 1970) and Greenland (BIRKELUND, HÅKANSSON, 1983) from strata with *Leymeriella* spp.

Subarcthoplites talkeetnanus Zone is the uppermost unit in the Lower Albian sections of the region. The zonal index, *S. talkeetnanus* (IMLAY) (Fig. 4, D, E), is typical for all studied outcrops, and is associated with *Grycia dubia* (I. MICH. et TER.) (Fig. 4, F), *Grantziceras affine* (WHIT.), *Parasilesites orientalis* I. MICH. et TER., *P. bullatus* IMLAY and, rarely, *Subarcthoplites bell.* (MCLEARN). The latter is known from strata with *Douvilleiceras* spp. in the Queen Charlotte Islands of British Columbia (MCLEARN, 1972).

Grycia pereziana Zone corresponds to the Middle Albian Substage and can be recognized in the Koryak-Kamchatka region, Pacific coast of Canada (JELETZTKY, 1977; HAGGART, 1986) and the USA (MURPHY, 1956; MATSUMOTO, 1960). In the latter area *Gr. pereziana* occurs together with *Oxytropidoceras packardi*. In the studied section *Gr. pereziana* FRAUNA contains the zonal index, *Gr. pereziana* (WHITEAVES) (Fig. 4, G, H), *Gr. dubia* (I. MICH. et TER.) *Grantziceras affine* (WHIT.) (Fig. 4, I), *G. glabrum* (WHIT.) and, in uppermost part numerous *Inoceramus anglicus* WOODS.

Rapidoplacenticeras sutherlandbrowni – Marshallites cumshewaensis Zone is recognized in the Sakhalin and Koryak-Kamchatka region of North-Eastern Russia, as well as in the Pacific coast areas of Canada and the USA. Both zonal indexes *R. sutherlandbrowni* (MCLEARN (Fig. 5, A, B) and *M. cumshewaensis* (WHITEAVES) (Fig. 5, C, D) are well known from the Upper Albian – Lower Cenomanian of NE Russia (ALABUSHEV, 1988 1989), Alaska (MATSUMOTO, 1959) and British Columbia (MCLEARN, 1972). This fauna contains numerous *M. columbianus* MCLEARN (Fig. 5, E, F) and *Neogastroplites americanus* (REESIDE et WEYMOUTH) (Fig. 5, G, H). The absence of *Gastroplites* spp. in the basal beds of the Mametchinskaya and Takynkuyulskaya Formations indicates a distinct hiatus between these formations and older strata. This hiatus corresponds to the earlymost part of the Late Albian, to the time of existence of the genus *Gastroplites*.

Subzone Pseudhelicoceras carlottense can be assigned in the lower part of the Zone, corresponding to the Upper Albian. Subzonal index, *P. carlottense* (WHITEAVES), was collected from Mametchinskaya and Takynkuyulskaya Formations of Kamchatka (POKHIALAYNEN, TEREKHOVA, 1984), accompanied by *Desmoceras (Pseudouhligella) dawsoni* (WHIT.). The upper part of this zone

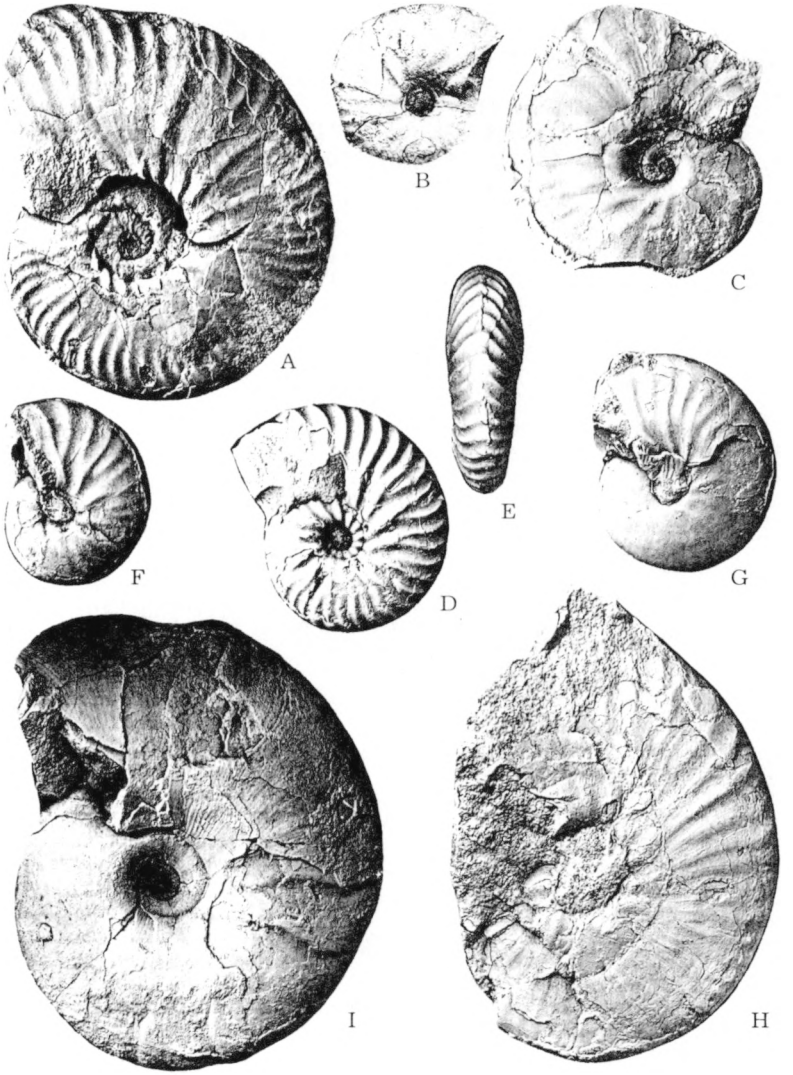

Fig. 4: Index-taxa of Lower and Middle Albian. A – *Leconteites deansi* (Whiteaves), specimen No. 851-3/1, Lowermost Albian, Ainyn area. B-C – *Freboldiceras singulare* Imlay, B – specimen No. 857-1/3, Lower Albian (Middle part), Ainyn area; C – specimen No. 853-1/1, item. D-E – *Subarcthoplites talkeetnanus* (Imlay), specimen No. 863-1/1, Lower Albian (upper part), Main Valley. F – *Grycia dubia* (I. Mich. et Ter.), specimen No. 857-3/3, Lower Albian, Ainyn area. G-H – *Grycia pereziana* (Whiteaves); G – specimen No. 858-1/6, Middle Albian, Ainyn area; H – specimen No. 865-1/1, Middle Albian, Main Valley. I – *Grantziceras affine* (Whiteaves), specimen No. 337/1, Lower Albian, Ainyn area.
Natural sizes. All material is kept in North-Eastern Interdisciplinary Scientific Research Institute, Magadan, Russia, collection No. 22s.

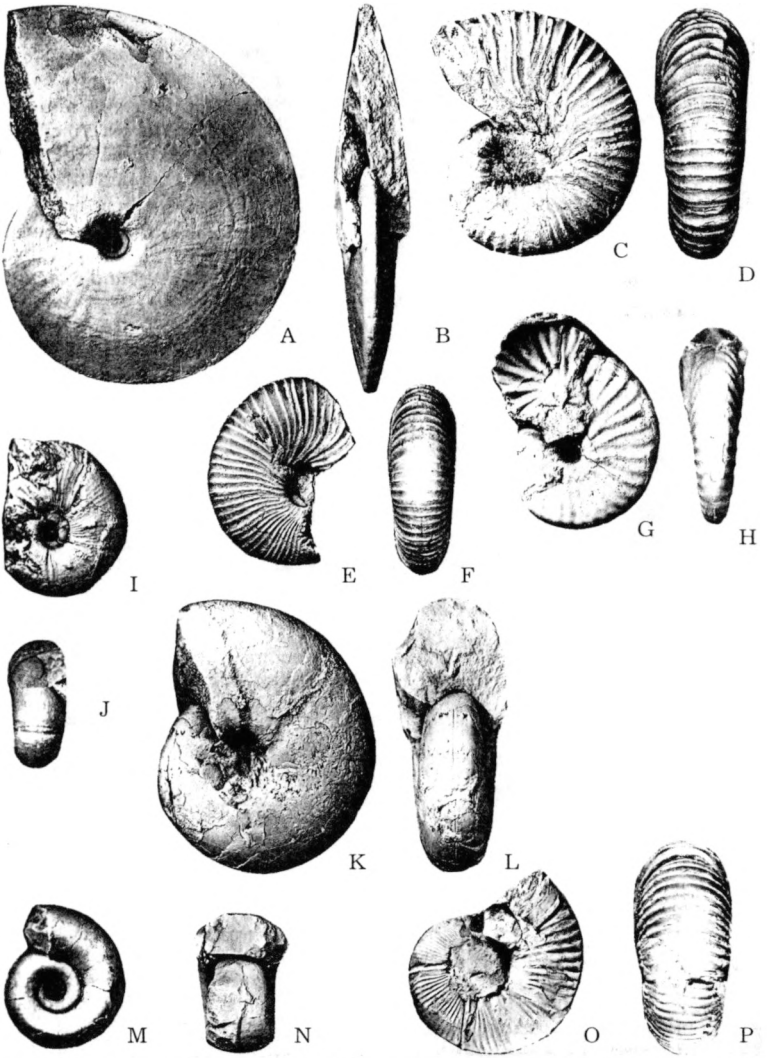

Fig. 5: Index-taxa of Upper Albian and Cenomanian. A-B – *Rapidoplacenticeras sutherlandbrowni* (McLearn), specimen No. 2060/4, Lower Cenomanian, Ainyn area. C-D – *Marshallites cumshewaensis* (Whiteaves), specimen No. 2117/1, Upper Albian, Ainyn area. E-F – *M. columbianus* McLearn, specimen no. 7844-1, Lower Cenomanian, Ainyn area. G-H – *Neogastroplites americanus* (Reeside et Weymouth), specimen No. 8429-1, Lower Cenomanian, Penzhina area. I-J – *Eogunnarites alaskensis* Matsumoto, specimen No. 7110-1, Lower Cenomanian, Ainyn area. K-L – *Desmoceras (Pseudouhligella) japonicum* (Yabe), specimen No. 8416-2, Lower Cenomanian, Penzhina area. M-N – *Parajaubertella kawakitana* Matsumoto, specimen No. 8516-2/1, Lower Cenomanian, Ainyn area. O-P – *Marshallites olcostephanoides* Matsumoto, specimen No. 8431-1, Middle Cenomanian, Penzhina area.
Natural sizes. All material is kept in North-Eastern Interdisciplinary Scientific Research Institute, Magadan, Russia, collection No. 22s.

contains *Eogunnarites alaskensis* MAT.: (Fig. 5, I., J), *E. unicus* MAT., *D. (Pseudouhligella) japonicum* MATSUMOTO (Fig. 5, K. L) *Parajaubertella kawakitana* MATSUMOTO (Fig. 5, M, N), as well as rare *Hypoturrilites gravesianus* (ORB.), *Mariella (M.) cenomanensis* (SCHLÜT.), and *Desmoceras kossmati* MAT. The extremely peculiar composition of this fauna indicates that the Hypoturrilites gravesianus Subzone can be assigned within the upper (Lower Cenomanian) part of the R. sutherlandbrowni – M. cumshewaensis Zone.

The Marshallites olcostephanoides Zone is defided by the co-occurrence of *M. olcostephanoides* MATSUMO (Fig. 5, O, P), *M. vayanus* (ANDERSON), *Mikasaites orbiculais* MAT., rare *Turrilites costatus* LAMARCK and *T. acutus* PASSY in the lower part as well as *Calycoceras* sp. and *Sciponoceras* sp. in the upper part of the zone. The *M. olcostephanoides* fauna is poorly preserved and rarely found. Stratigraphically higher strata contain numerous *Gaudryceras tenuiliratum* YABE (s. l.), which indicates a Turonian age of the rocks.

Albian-Cenomanian boundary

There are three different methods of determination of the boundary between Albian and Cenomanian Stages in North-Eastern Russia:

1. At the base of the *Turrilites costatus* or the *Inoceramus subovatus* Zone (TEREKHOVA, 1969; 1979; MIROLYUBOS (see: POYARKOVA, 1987).
2. At the base of strata containing *Neogastroplites americanus* (VERESCHAGIN, 1977).
3. At the base of the *Inoceramus* aff. *I. crippsi* – *Desmoceras kossmati* (PERGAMENT, 1969) Zone.

By the author, the boundary of Albian and Cenomanian and thus Lower and Upper Cretaceous should be drawn according to the first appearance of *Parajaubertella kawakitana* MAT., *Eogunnarites alaskensis* MAT. or *Desmoceras (Pseudouhligella) japonicum* MAT. This level corresponds to the exchange of the genus *Pseudhelicoceras* by the genus *Hypoturrilites* among Turrilitidae.

Conclusions

Six ammonite faunas or zones are recognized by stratigraphic and geographic distribution of fossils within Albian and Cenomanian rocks of North-Eastern Russia. The four lower zones cannot be assigned to Albian strata of Southern Sakhalin for the complete lack of zonal indexes and characteristic fossils. Consequently, the cross-section from Albian to Cenomanian strata in North-Western Kamchatka (Ainyn area) may be used as a reference section for the North-Western Pacific area. All recognized zones and ammonite faunaus are well exposed in this area.

Several of the ammonite zones and faunas, which are recognized in the Koryak-Kamchatko region of NE Russia occur in the Pacific coast region of Canada and the USA. A confident correlation of studied sections using the European standard sequence is possible through Southern Alaskan and British Columbian outcrops. Finds of turrilitids and rare Middle-Cenomanian *Acanthoceras sussexiense* MANTELL, as well as *Calycoceras* sp. and *Sciponoceras* sp. have the greatest value for correlation.

The stratigraphic and geographic distribution and taxonomic composition of fossils indicate that the Koryak-Kamchatka Province of the Northern Pacific was separate during Early and Middle Albian and communicated with the Southern Alaskan Province only. The global distinctions between paleobasins of

subtropic and temperate zones became well defined from Late Albian onward. The migration routes of ammonites between Japan, California, Northern America (so-called Neogastroplites Province) and the Koryak-Kamchatka region were established at the beginning of the Late Albian. The faunal exchange between the North Atlantic and North Pacific Oceans was possible during the Middle Cenomanian.

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I am indebted to Dr. V. P. POKHIALAYNEN, North-Eastern Interdisciplinary Scientific Research Institute, Russian Academy of Sciences, Magadan, who supported me and suggested improvements during all these studies. O. GABALOV, O. MALTZEV, B. POSTNIKOV; S. TENIN, A. V. ALABUSHEVA and V. ALABUSHEV gave distinguished asstistance in my field research. Further thanks are due to Prof. Dr. MORRIS PETERSON, University Provo, Utah, U.S.A., for corrections of the manuscript. This study was accomplished under financial support of the Alexander von Humboldt Foundation.

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