N. Jb. Geol. Paläont. Abh.	196	1	109–139	Stuttgart, März 1995

Ammonite faunas and biostratigraphy of the Albian to Middle Cenomanian (Cretaceous) in western Korjak-Kamchatka, NE Russia

By

A. Alabushev, Tübingen

With 11 figures and 1 table in the text

ALABUSHEV, A. (1995): Ammonite faunas and biostratigraphy of the Albian to Middle Cenomanian (Cretaceous) in western Korjak-Kamchatka, NE Russia. – N. Jb. Geol. Paläont. **196**: 109–139; Stuttgart.

Abstract: Most of the known ammonite faunas from the Albian to Middle Cenomanian formations of Korjak-Kamchatka, northeastern Russia, are revised and summarized. 7 poorly known species are described. 22 other species are illustrated and mentioned in the discussion. A new ammonite zonal scheme is proposed for the Albian to Middle Cenomanian of the region.

Zusammenfassung: Die meisten Ammonitenfaunen des Albs bis Mittel-Cenomans von Korjak-Kamtschatka (NE Rußland) werden zusammengefaßt und revidiert. 7 weniger bekannte Arten werden beschrieben. 22 weitere Arten werden diskutiert und abgebildet. Als Ergebnis wird ein neues Ammoniten-Zonen-Schema für das Alb bis Mittel-Cenoman der Region vorgestellt.

1. Introduction

Albian to Cenomanian sedimentary formations are exposed along the axial part of Korjak-Kamchatka, a main Mid-Cretaceous depocenter in the Pacific margin of NE Russia (Fig. 1). The rocks were deposited in the miogeosynclinal trough between the foreland of the Okhotsk-Chukchi volcano-plutonic belt and a system of island arcs, which migrated towards the foreland during the Albian and away from it since the Cenomanian (ALABUSHEV & WIEDMANN 1994b, ALABUSHEV, in press).

The most complete Mid-Cretaceous successions of true marine deposits are known in the western Korjak-Kamchatka, namely: Talovka and Penzhina river basins (Fig. 1). They are described by AVDEIKO (1968), IVANOV & POKHIALAYNEN

0077-7749/95/0196-0109 $ 7.75

(1973), PERGAMENT (1965), and VERESHCHAGIN (1977). Unfortunately, only a small part of the ammonite faunas collected was illustrated with short biostratigraphic comments (POKHIALAYNEN & TEREKHOVA 1984, VERESHCHAGIN et al. 1965).

Other Albian to Middle Cenomanian sections are well exposed in the western part of Main Valley (Fig. 1). These formations have been studied by TEREKHOVA (1969) and with colleagues (TEREKHOVA & BASOV 1972, TEREKHOVA & DUNDO 1987). They described the most important stratigraphic sequences and listed all the fossils collected. Ammonite faunas have been illustrated in a few taxonomic papers (MIKHAILOVA & TEREKHOVA 1975, TEREKHOVA & MIKHAILOVA 1977) and unpublished official reports.

The data concerning ammonite faunas and the Albian to Lower Cenomanian biostratigraphy have been summarized by the author in his earlier papers (ALABUSHEV 1988, 1989a, 1989b; ALABUSHEV & ALABUSHEVA 1988; ALABUSHEV & WIEDMANN 1994a, 1994b).

In general, the Albian to Lower Cenomanian faunas differ from those of the Boreal and Thethyan realms by (a) an absence of corals, belemnitids, rudistids, echinoids and Albian foraminifers, (b) a presence of numerous endemic taxa, and (c) a wide distribution of the specific rock-forming group of bivalves (mainly Trigoniidae), gastropods (most of Neritidae) and brachiopods (genus *Mametothyris* SMIRNOVA). Besides the listed features, the region is characterized by a complete absence of some ammonite taxa, such as Douvilleiceratidae, Dipoloceratidae, Engonoceratidae and Mantelliceratinae. These peculiarities reflect the existance of a separate Korjak-Kamchatka Paleobiogeographical Province within the North Pacific Realm. (The Korjak-Kamchatka Province in the author's understanding is similar to the Anadyr'-Korjak region of VERESH-

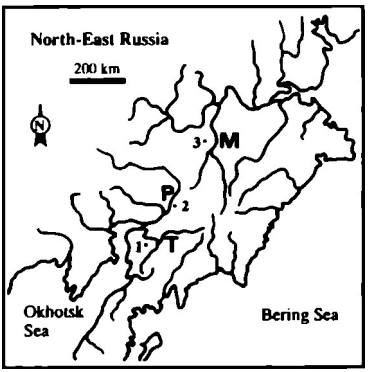

Fig. 1. Regional map showing exposure areas (T, P, M) and studied localities (1-3). Simbols: T - Talovka basin, P - Penzhina basin, M - Main basin, and 1 - Ajnyn River, 2 - Niklekujul River, 3 - Kruglokamennaja River.

CHAGIN (1977), but is more precisely delimited in a spatial sense). From the Middle Cenomanian (*Turrilites*-invasion) onward, this faunal provincialism disappears. In the present paper, I describe and discuss the ammonite faunas from the Albian to Middle Cenomanian rocks of western Korjak-Kamchatka. The deposits examined outcrop in the Ajnyn, Talovka, Penzhina and Main valleys and are divided herein into an older, Kedrovskaja Formation, and younger Mametchinskaja and Lower Takynkujulskaja formations which formed contemporaneously.

The material illustrated is kept in the North-Eastern Interdisciplinary Scientific Research Institute, Russian Academy of Sciences, Magadan (NEIM), and in the Geologisch-Paläontologisches Institut, Tübingen (GPIT).

Abbreviations used

BMNH - The Natural History Museum, London; **BGS** - British Geological Survey, Keyworth; **GSC** - Geological Survey Canada, Ottawa; **MGGU** - Museum of the Geological Survey of Greenland; **MGU** - Moscow University, Russia; **USNM** - U. S. National Museum, Washington; **D** - Diameter, **U** - Width of umbilicus, **H** - Height, **B** - Breadth.

2. Collections and conception

Albian to Cenomanian ammonites from Korjak-Kamchatka were first collected by POLEVOJ in 1912-13, ELISEEV in 1933-34 and KHVATOV in 1935-36. Other collections were made by MIKHAILOV, PERGAMENT, EGIAZAROV, RUSAKOV, DUNDO, MIGOVICH, TARASENKO, and AVDEIKO during 1955-65, but unfortunately, most of these fossils are lost. However, the collections of POKHIALAYNEN, TEREKHOVA, and ALEKSEEV, made in 1959-71, are largely complete. The author collected material during 1984-88, and SHELUDCHENKO and EVGLEVSKIJ in 1985-86.

A reinvestigation of the typical ammonite faunas from Korjak-Kamchatka indicates that most of so-called "regional endemics" of earlier authors are undoubtedly synonymous with species described from elsewhere in the Arctic region. The author has endeavoured to avoid the earlier tendency to treat the faunas in isolation by the examination of the many important collections in museums in Russia, Germany, France and Great Britain.

3. Stratigraphy

The Albian to Middle Cenomanian successions are represented by interbedded silty-sandy deposits containing pebbly and coaly seams. Exposures are generally located along the northward flowing streams, which cross the structure of the region.

3.1 Lower to Middle Albian rocks (Kedrovskaja Formation)

In the Ajnyn Valley (Fig. 1), the Lower to Middle Albian deposits overlie Aptian marine rocks with partial disconformity (Fig. 2). The appearance of a lowermost Albian pebbly-vitroclastic facies with glendonite crystal aggregates and the wide occurrence of a Middle Albian turbidite facies are noteworthy. North of Ajnyn area, these strata are characterized by an increasing number of intraformational conglomerate beds and interfoliated coal seams. Towards the NE, the strata progressively overlap older rocks and are characterized by a greater thickness of the basal and intraformational conglomerates (Fig. 2). Intrusive rocks are present in these conglomerates. The Lower to Middle Albian rocks of the Ajnyn Valley were grouped by PERGAMENT (1965) into the Kedrovskaja Formation and this has been followed subsequently by authors.

In the Niklekujul Valley, a southern tributary of the Penzhina River (Fig. 1), the Lower to Middle Albian strata consist of coarse terrigenous deposits with a predominantly sandy-pebbly lithofacies and a local distribution of Middle Albian turbidite facies (Fig. 2). These sediments rest unconformably on faulted Valanginian rocks. The basal Albian conglomerate beds include several thin (3-10 cm) layers of vitric tuff containing star shaped glendonite druses. Mainly effusive rocks and silicious siltstone are the pebble components of the conglomerates. The Albian strata of this area was described by MIGOVICH & TARASENKO (unpublished official report) as the Niklekujulskaja Formation; a name very rarely used.

Towards the Main Valley (Fig. 1), the Lower to Middle Albian strata become more fine-grained, but they include several boulder horizons containing rocks ranging in age from Carboniferous to Cretaceous. A well exposed section of fossiliferous Albian strata is situated along the Kruglokamennaja River (Fig. 2), a western tributary of the Main River. This succession overlies unconformably Hauterivian marine rocks. The basal Albian beds include three thin (5-12 cm) vitric tuff layers.

The unnamed Lower to Middle Albian beds and accompanying faunas in the Main Valley are absolutely identical to those of the Kedrovskaja Formation in the Ajnyn Valley and the Niklekujulskaja Formation in the Penzhina Valley according to my observations. A single Kedrovskaja Formation to include all these sedimentary successions is adopted here to avoid unnecessary nomenclatorial complexity.

Fig. 2. Correlation of the Albian to Middle Cenomanian strata of Korjak-Kamchatka. Simbols: **1** - regional unconformity, **2** - local disconformity, **3** - conglomerate and pebbly facies, **4** - pebbly-vitroclastic facies, **5** - redeposited fossiliferous concretions, **6** - coal and coal-grit, **7** - coarse-grained sandstone, **8** - fine-grained sandstone, **9** - siltstone, **10** - flysch facies, **11** - shale.

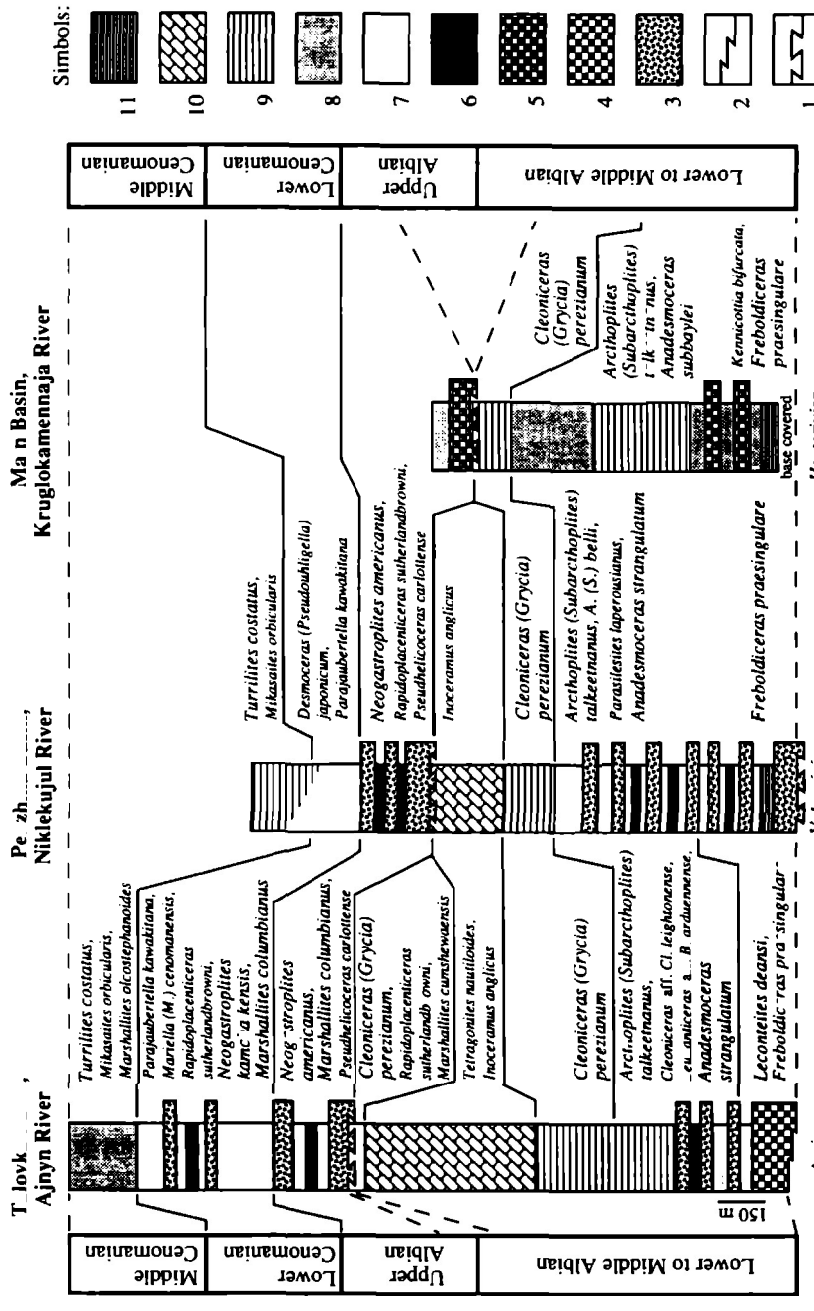

Fig. 2 (Legend see p. 112)

3.2 Upper Albian to Middle Cenomanian (Mametchinskaja and Lower Takynkujulskaja formations)

Basal beds of the younger marine formation in the Ajnyn Valley are represented by thick-bedded conglomerates with thin coaly seams (Fig. 2). This facies is characterized by the appearance of granitoid pebbles in the conglomerates. The overlaying strata include interbedded sandy-silty-pebbly deposits with a predominance of fine-grained siltstones at the top. Large flow rools are a typical feature of the sandy deposits. This succession corresponds to the Mametchinskaja Formation of PERGAMENT (1961). Subsequently, the lithological composition and stratigraphical range of these sediments have been discussed by IVANOV and POKHIALAYNEN (1973). The Formation name is now widely used for the Upper Albian to Middle Cenomanian rocks widespread in the westernmost Korjak-Kamchatka.

Upper Albian to Middle Cenomanian deposits in the Penzhina Valley are sandy and pebbly with a thick-bedded basal conglomerate containing coaly seams (Fig. 2). The conglomerate facies includes, mainly, granitoid and silicious shale pebbles. The overlying beds are characterized by a lateral northeastward gradation of coarse-grained sandstone into siltstone. The strata correspond to the Lower Member of Takynkujulskaja Formation of MIGOVICH & TARASENKO (unpublished official report) including a complex of Upper Alban to Upper Turonian sedimentary rocks which are widespread in the Pontonej Mountain Range, south of Penzhina Valley.

Pebbly sediments containing redeposited debris with Lower to Middle Albian faunas are locally distributed in the Upper Main Valley in deposits which are, most likely, of Upper Albian age. The undoubted Cenomanian fossiliferous rocks are known in the Main Mountain Range (ALABUSHEV & WIEDMANN 1994a, TEREKHOVA 1969, TEREKHOVA & MIKHAILOVA 1977), but their relation with older strata is still unknown.

3.3 Stratigraphic summary

The Albian to Middle Cenomanian rocks of western Korjak-Kamchatka are divided into Kedrovskaja, Mametchinskaja and Lower Takynkujulskaja formations. The lowest formation is the Kedrovskaja of Lower to Middle Albian age and is of widespread occurrence in the Talovka, Penzhina and Main basins and may be correlated between distal areas by a specific basal facies containing vitric tuffs and glendonites. The other two formations are contemporaneous in age and include coarse-grained sediments ranging from the Upper Albian to the Middle Cenomanian. At their top they may be correlated by the mass occurrence of *Turrilites costatus* LAMARCK. The Mametchinskaja Formation is developed in the westernmost Korjak-Kamchatka, whereas the Takynkujulskaja Formation is developed in the Penzhina Valley. Towards the Main Valley, the erosional hiatus between older and younger formations becomes more pronounced.

Table 1. Biozonation and correlation of the Albian to Middle Cenomanian deposits of Korjak-Kamchatka.

<table>
<tr><th colspan="2" rowspan="2">European standard</th><th colspan="4">K o r j a k - K a m c h a t k a</th></tr>
<tr><th colspan="2">Present paper</th><th>ALABUSHEV 1989a</th><th>PARAKETSOV et al. 1974</th></tr>
<tr><td>Middle Cenom.</td><td>Turrilites costatus</td><td colspan="2">Turrilites costatus</td><td>Turrilites costatus</td><td rowspan="2">Turrilites costatus</td></tr>
<tr><td rowspan="2">Lower Cenomanian</td><td>Mantelliceras dixoni</td><td rowspan="3">Marshallites columbianus</td><td>Neogastroplites kamchatkensis</td><td rowspan="3">Neogastroplites americanus - Marshallites columbianus</td></tr>
<tr><td>Mantelliceras cantianum</td></tr>
<tr><td rowspan="2">Upper Albian</td><td>Stoliczkaia dispar</td><td>Neogastroplites americanus</td><td rowspan="2">Neogastroplites americanus - Marshallites columbianus</td></tr>
<tr><td>Mortoniceras inflatum</td><td colspan="2">regional gap</td></tr>
<tr><td rowspan="2">Middle Albian</td><td>Euhoplites lautus</td><td colspan="2" rowspan="2">Cleoniceras (Grycia) perezianum</td><td>Inoceramus anglicus</td><td rowspan="3">Inoceramus anglicus</td></tr>
<tr><td>Hoplites dentatus</td><td rowspan="2">Cleoniceras (Grycia) dubium</td><td>Cleoniceras (Grycia) perezianum</td></tr>
<tr><td rowspan="2">Lower Albian</td><td>Douvilleiceras mammillatum</td><td>Arcthoplites (Subarcthoplites) talkeetnanus</td><td>Parasilesites spp.</td><td>Arcthoplites (S.) talkeetnanus</td><td>Cleoniceras (Grycia) dubia - Cl. (G.) sablei</td></tr>
<tr><td>Leymeriella tardefurcata</td><td colspan="2">Anadesmoceras strangulatum</td><td>Freboldiceras singulare</td><td>Freboldiceras singulare</td></tr>
<tr><td colspan="2">Freboldiceras praesingulare - Leconteites deansi</td><td>Leconteites deansi - Kennicottia bifurcata</td><td>Leconteites deansi - Kennicottia bifurcata</td></tr>
</table>

The mineralogical composition of the clasts indicates that a likely source for the sediments in the northwestern part of studied area might have been the old basement and effusive covers of the Okhotsk-Chukchi volcano-plutonic belt, whereas the source for southeastern part of the area was, most likely, "green tuffs"formations derived from the young island arcs.

The wide occurrence of glendonite aggregates in the base of Kedrovskaja Formation is noteworthy. According to KEMPER (1983), these pseudomorphs of calcite after thenardite indicate cool water temperatures in the basin. However, the detailed connection between the mineral genesis and environmental temperature have yet to be determined. Nevertheless, this occurrence of glendonite may be used for long-distance correlation within a common sedimentary basin.

The regional distribution of the Middle Albian turbidite facies indicates basin inversion and foreshadowed the beginning of the molassoid (sensu lato) depositional stage.

The peculiar conglomerate facies in the Main Valley, consisting of redeposited older fossiliferous clastic debris including Palaeozoic rocks, indicates, most likely, a local occurrence of island-bars. They might have been related to compressional forces within the active continental margin due to a shift of island arcs towards the continent in the Albian.

4. Ammonite faunas and zones

The ammonite biostratigraphic zonation of the Albian to Middle Cenomanian deposits of Korjak-Kamchatka (Table 1) has been discussed by ALABUSHEV (1989a), ALABUSHEV and WIEDMANN (1994b), AVDEIKO (1968), IVANOV and POKHIALAYNEN (1973), PARAKETSOV and others (1974), PERGAMENT (1977), and VERESHCHAGIN (1977).

The scheme proposed by AVDEIKO (1968) was developed on the basis of a number of isolated localities in the Talovka Valley and is not accurate enough for a long-distance correlation. However, this scheme is very often referred to in recent papers (JELETZKY 1980, JELETZKY & STELCK 1981, PERGAMENT 1977, TEREKHOVA & DUNDO 1987, VERESHCHAGIN 1977).

More correct, but still poorly known, local and unified regional biostratigraphic schemes were proposed and developed by IVANOV and POKHIALAYNEN (1973), PARAKETSOV and others (1974), and by TEREKHOVA and DUNDO (1987). The author's concept of ammonite biozonation (ALABUSHEV 1989a) has been based on these published data, his own field observations and an investigation of additional collections. Presently, the following ammonite faunas and zones, in descending order, are recognized within the Albian to Middle Cenomanian successions of western Korjak-Kamchatka (Table 1):

Turrilites costatus Zone

Marshallites columbianus Zone including *Neogastroplites kamchatkensis* (upper) and *N. americanus* (lower) subzones

Cleoniceras (Grycia) perezianum Zone
Arcthoplites (Subarcthoplites) talkeetnanus Zone including *Parasilesites* spp. (upper) and *Anadesmoceras strangulatum* (lower) subzones
Freboldiceras praesingulare - Leconteites deansi Zone.

4.1 *Freboldiceras praesingulare - Leconteites deansi* Zone

The lowermost Zone is recognized by the zonal indices, *F. praesingulare* BIRKELUND & HÅKANSSON (Figs. 6 E-G) and *L. deansi* (WHITEAVES) (Fig. 9 A), as well as *Anagaudryceras aurarium* (ANDERSON) (Figs. 3 C, D; = *Gaudryceras penjiensis* VERESHCHAGIN: VERESHCHAGIN et al., 1965, pl. 17, fig. 2, pl. 18, figs. 4 a, b; = *Anagaudryceras madraspatanum* AVDEIKO non STOLICZKA: AVDEIKO, 1968, pl. 2, figs. 8 a-g), and rare *Grantziceras affine* (WHITEAVES) (Fig. 5 B-D; = *Beudanticeras* sp.: VERESHCHAGIN et al., 1965, pl. 19, pl. 20, fig. 1; = *Beudanticeras penjiensis* AVDEIKO, 1968, pl. 5, figs. 3-5, pl. 6, fig. 1, pl. 7, fig. 1). The Zone stratotype is situated in the Ajnyn Valley near mouth of Bol'shoj Creek.

In the type locality, the underlying poorly fossiliferous tuffite strata of the Tikhorechenskaja Formation are, usually, correlated with the Upper Aptian due to often cited finds of the ammonite *Tropaeum (?) kajgorodzevi* (VERESHCHAGIN) (e. g. IVANOV & POKHIALAYNEN 1973: 77; PERGAMENT 1977: 87). However, undoubted fragments of this species have been found only in the Pekul'nej Mountain Range (TEREKHOVA 1972), very far from the studied area. The other important ammonite, formerly identified as *Sonneratia* sp., has been found in the uppermost part of the Tikhorechenskaja Formation in the Ajnyn Valley (IVANOV & POKHIALAYNEN 1973: 77). The illustrated specimen of this form (VERESHCHAGIN et al. 1965, p. 33, pl. 18, fig. 2) is re-identified here as *Pachygrycia canadensis* JELETZKY & STELCK. In the original description, JELETZKY and STELCK (1981: 5) tentatively ascribed this form to the species *canadensis*, having a latermost Aptian (?) to earliest Albian age. In Canada, the species includes ammonites, which have been cited by JELETZKY (1964, 1971, 1975) as *Sonneratia (s. l.)* and *S.* (s. l.)? n. sp. A., as well as by STELCK and others (1956) as *Sonneratia* cf. *kitchini* SPATH. The earliest Albian age of the top of Tikhorechenskaja Formation is, therefore, probable.

Deposits of *F. praesingulare - L. deansi* Zone age can be traced towards the Main Valley, where the other characteristic Lower Albian species, *Kennicottia bifurcata* IMLAY (Fig. 6 H), has also been collected.

The first index-species is known from the lowermost Albian strata of North Greenland (BIRKELUND & HÅKANSSON 1983) and Spitsbergen (NAGY 1970), where it was collected below *Arcthoplites*-bearing beds of *acuticostata* subzone age and is associated in Peary Land, North Greenland, with *Proleymeriella* indicating the *schrammeni* subzone of the European zonation (OWEN 1988). The second one is widespread in the Pacific seaboard of USA and Canada (IMLAY 1960, JELETZKY 1971, JONES 1967, JONES, MURPHY & PACKARD 1965). In

the former region, *Leconteites*-bearing beds are underlain by the uppermost Aptian *Acanthohoplites reesidei* Zone (ANDERSON 1938, JELETZKY 1977, MURPHY 1956). The other accompanying species, such as *Anagaudryceras aurarium* (ANDERSON), *Kennicottia bifurcata* IMLAY, and *Hulenites* sp. (Figs. 7 G, H), indicate, most likely, earliest Albian age of the beds by analogy with their stratigraphic range in North America (IMLAY 1960, 1961, JONES 1967, MURPHY 1967).

Thus, the Zone corresponds to lowest part of the Lower Albian.

4.2 *Arcthoplites (Subarcthoplites) talkeetnanus* Zone

The conformably overlaying *Arcthoplites (Subarcthoplites) talkeetnanus* Zone is characterized by wide distribution of the zonal index, *A. (S.) talkeetnanus* (IMLAY) (Figs. 10 F-K), and accompanying numerous *Cleoniceras (Grycia) dubium* MIKHAILOVA & TEREKHOVA (Figs. 8 C-E), *Grantziceras affine* (WHITEAVES) (Figs. 6 A, B), and *Grantziceras glabrum* (WHITEAVES) (= *Beudanticeras giganteus* AVDEIKO, 1968, pl. 7, figs. 5 a, b), as well as *Parasilesites bullatus* IMLAY (Figs. 7 A, B), *P. laperousianus* (WHITEAVES) (Figs. 7 C-F), *P. orientalis* MIKHAILOVA & TEREKHOVA (1975, pl., figs. 1-4), *Beudanticeras* aff. *B. arduennense* BREISTROFFER (Figs. 4 C-G; 5 A), rare *Arcthoplites (Subarcthoplites) belli* MCLEARN (Fig. 10 B), *A. (S.) mcconnelli* (WHITEAVES) (Figs. 10 C-E), solitary *Cleoniceras* aff. *Cl. (Cl.) leightonense* SPATH (Figs. 8 A, B), and *Brewericeras* sp. in the upper part of the Zone.

In continuous sections of the Ajnyn Valley, the first appearance of the index species is marked about 20 m stratigraphically above the last find of *Leconteites deansi* and 40 m above that of *Freboldiceras praesingulare*. The nearly simultaneous appearance of *Anadesmoceras strangulatum* CASEY (Figs. 9 D-G), *A. subbaylei* (SPATH) (Figs. 9 B, C; 10 A) and the zonal index indicates that the latter species ranges, at least, from the Lower Albian *acuticostata* subzone. Moreover, the typical specimens of so-called North Pacific endemic *A. (S.) talkeetnanus* are very similar to some of *Cymahoplites caseyi* MIKHAILOVA (1974) and *Arcthoplites jahromensis* BIRKELUND & HÅKANSSON (1983) non NIKITIN, 1888, from *tardefurcata* Zone s. s. of European regions (see synonymy).

Two subzones, *Anadesmoceras strangulatum* and *Parasilesites* spp. may be assigned within the *A. (S.) talkeetnanus* Zone (Table 1). By analogy with Pacific regions of North America (ANDERSON 1938; JELETZKY 1977, JONES, MURPHY & PACKARD 1965, MURPHY 1956), the second subzone approximately corresponds to the *mammillatum* Superzone of European standard.

4.3 *Cleoniceras (Grycia) perezianum* Zone

The Middle Albian *Cleoniceras (Grycia) perezianum* Zone contains the zonal index, *Cl. (G.) perezianum* (WHITEAVES) (Figs. 8 F-H), as well as *Cl. (G.) dubium* MIKHAILOVA & TEREKHOVA, *Puzosia skidegatensis* MCLEARN (Figs. 6

C, D), rare *Grantziceras affine* (WHITEAVES) and *Cl. (G.) sisukii* MURPHY & RODDA (Figs. 8 I, K), as well as *Tetragonites nautiloides* PICTET.

This Zone is also recognized in the Pacific coastal areas of Canada (HAGGART 1986, JELETZKY 1977, MCLEARN 1972) and USA (MURPHY 1956). According to JELETZKY (1977), the Zone is equivalent to the *Oxytropidoceras packardi* Zone of California after MURPHY (1956). However, the latter one was assigned in separated locality, unconnected with the well exposed depositional succession along the Hulen Creek, northern California. MCLEARN (1972: 19) remarked that the *Cl. (G.) perezianum* Zone "cannot be compared directly with any of the Pacific coast zones".

In the Ajnyn Valley, uppermost beds of the Zone contain very interesting ammonite association including, besides the above listed species, *Ammonoceratites crenocostatus* (WHITEAVES), *Anagaudryceras sacya* (FORBES) (Figs. 3 G, H), *Marshallites cumshewaensis* (WHITEAVES) (Figs. 7 I, K), and *Rapidoplacenticeras sutherlandbrowni* (MCLEARN) (Figs. 11 E-I). Previously, the two latter species were mistakenly described by AVDEIKO (1968) as *Scaphites mametensis* and *Cleoniceras (Neosaynella) discoides*. This complex is very similar to that of the Insular Belt of Canada. MCLEARN (1972) listed all forms mentioned above as well as *Desmoceras (Pseudouhligella) bearskinense* MCLEARN and *Zelandites* sp. for the top of the *Cl. (G), perezianum* Zone in the Queen Charlotte Islands. The cited species are typical for the overlying younger sequences which are separated by subaerial unconformity almost totally in the North Pacific.

4.4 *Marshallites columbianus* Zone

The *Marshallites columbianus* Zone is recognized by zonal index, *M. columbianus* MCLEARN (Figs. 7 L, M), *M. cumshewaensis* (WHITEAVES), *Rapidoplacenticeras sutherlandbrowni* (MCLEARN) and *Anagaudryceras sacya* (FORBES) which are well known from the Upper Albian to Lower Cenomanian of the Pacific seaboard of Russia (ALABUSHEV 1989a, ALABUSHEV & WIEDMANN 1994b), USA (MATSUMOTO 1959) and Canada. In the latter region, the lowermost specimens of the index-taxon have been collected from the *Mortoniceras - Desmoceras (Pseudouhligella) dawsoni* Zone (uppermost Albian) in the Bearskin Bay, Quenn Charlotte Islands (MCLEARN 1972).

In Korjak-Kamchatka, the lower part of this Zone of late Upper Albian age contains also *Neogastroplites americanus* (REESIDE & WEYMOUTH) (Figs. 11 A, B), rare *Phylloceras seresitense tanit* (PERVINQUERE) (Figs. 3 A, B) and *Pseudhelicoceras carlottense* (WHITEAVES) (POKHIALAYNEN & TEREKHOVA, 1984, pl. 15, figs. 3-5, text-figs. 1-3). These strata may be correlated with the *Neogastroplites americanus* subzone. The upper part of the Zone contains *Neogastroplites kamchatkensis* ALABUSHEV & WIEDMANN (Figs. 11 C, D), *E. unicus* (YABE) (Figs. 7 O, P), *Desmoceras (Pseudouhligella) japonicum* YABE (Figs. 4 A, B), *Parajaubertella kawakitana* MATSUMOTO, as well as extremely rare *Mariella*

(M.) cenomanensis (SCHLÜTER) (TEREKHOVA & MIKHAILOVA 1977, pl. 2, figs. 1-5), *Hypoturrilites gravesianus* (d'ORBIGNY), and *Desmoceras kossmati* MATSUMOTO (POKHIALAYNEN 1985; TEREKHOVA 1969; VERESHCHAGIN 1977). The largely peculiar composition of this fauna allows for recognition of a *Neogastroplites kamchatkensis* subzone within an upper part of the *M. columbianus* Zone corresponding to the Lower Cenomanian.

4.5 *Turrilites costatus* Zone

The conformably overlying Middle Cenomanian deposits are defined everywhere in the Pacific coast of Russia by the occurrence of *Turrilites costatus* LAMARCK (Figs. 3 I-L; EFIMOVA & TEREKHOVA 1966, pl. 2, fig. 2; TEREKHOVA & MIKHAILOVA 1977, pl. 1, figs. 1-3; VERESHCHAGIN et al. 1965, pl. 26, fig. 1), *Desmoceras (Pseudouhligella) japonicum* YABE, *Mikasaites orbicularis* MATSUMOTO (VERESHCHAGIN et al. 1965, pl. 26, fig. 2), *Marshallites olcostephanoides* MATSUMOTO, and rare *Acanthoceras sussexiense* MANTELL (VERESHCHAGIN et al. 1965, pl. 26, fig. 3).

4.6 Concluding biostratigraphic remarks

The stratigraphic distribution of the ammonite faunas within the Albian to Middle Cenomanian of western Korjak-Kamchatka reflects the continuous existence of North Pacific endemic taxa and the short-term invasions of cosmopolitan ones, such as:

Anadesmoceras strangulatum CASEY, *A. subbaylei* (SPATH), *Cleoniceras* aff. *Cl. (Cl.) leightonense* SPATH, and *Beudanticeras* aff. *B. arduennense* BREISTROFFER in the early Albian; *Phylloceras seresitense tanit* PERVINQUERE in the late Albian; *Hypoturrilites gravesianus* (d'ORBIGNY) and *Mariella (M) cenomanensis* (SCHLÜTER) in the early Cenomanian; *Turrilites costatus* LAMARCK and *Acanthoceras sussexiense* MANTELL in the mid-Cenomanian.

These invaders from the European basins indicate the fact that migration routes to the North Pacific took place repeatedly during the Early Albian (*acuticostata*, *regularis* and *floridum* subzones of the European standard), were absent in the Middle Albian and increased in occurrence from the late Albian to the Middle Cenomanian.

A regional gap between the Middle Albian *perezianum* Zone and the unconformably overlying *columbianus* Zone corresponds to the *Gastroplites* (s. s.) Zone, in the sense of JELETZKY (1980), which commences in the early Upper Albian in the author's opinion. This major non-sequence between the Middle and Upper Albian sediments becomes, however, more pronounced towards the NE (Main Valley).

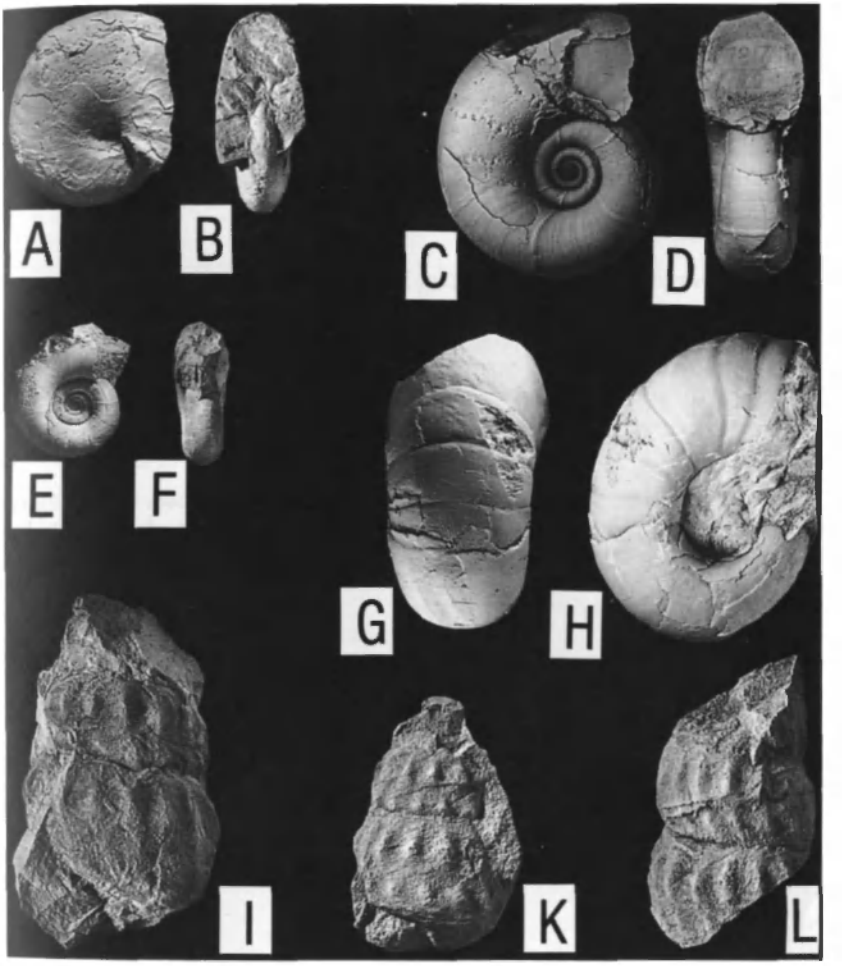

Fig. 3. Suborders Phylloceratina and Lytoceratina. **A, B** - *Phylloceras seresitense tanit* (Pervinquière); GPIT 1736-1, uppermost Albian, Kruglokamennaja River. **C-F** - *Anagaudryceras auvarium* (Anderson); NEIM 22s/7817-5, lowermost Albian, Ajnyn River. **G, H** - *Anagaudryceras sacya* (Forbes); NEIM 22s/8507-4, uppermost Middle Albian, Ajnyn River. **I-L** - *Turrilites costatus* Lamarck; **I, K** - GPIT 1736-2, -3, Middle Cenomanian, Ajnyn River; **L** - GPIT 1736-4, Middle Cenomanian, Main basin. Here and further all specimens are given in 90 % of natural size.

5. Systematic descriptions of selected species

Suborder Ammonitina HYATT, 1889
Superfamily Desmoceratacea ZITTEL, 1895
Family Desmoceratidae ZITTEL, 1895
Subfamily Puzosiinae SPATH, 1922
Genus *Freboldiceras* IMLAY, 1959

Type-species: *Freboldiceras singulare* IMLAY, 1959.

Freboldiceras praesingulare BIRKELUND & HÅKANSSON
Figs. 6 E-G

1968 *Freboldiceras singulare* IMLAY. – AVDEIKO, p. 116, pl. 16, figs. 2, 3, 5-7.
1970 *Freboldiceras singulare* IMLAY. – NAGY, p. 48, pl. 6, fig. 3.
1983 *Freboldiceras praesingulare*. – BIRKELUND & HÅKANSSON, p. 17, pl. 1, figs. 6-15.
1988 *Freboldiceras singulare* IMLAY. – ALABUSHEV & ALABUSHEVA, p. 10, pl. 1, figs. 4, 5.

Holotype: Specimen MGGU 15982 from the lowermost Albian beds of East Peary Land, North Greenland, figured by BIRKELUND and HÅKANSSON (1983, pl. 1, figs. 11a-b), associated with *Proleymeriella*.

Material: 7 satisfactorily preserved specimens from the basal Albian beds of Ajnyn, Penzhina and Main areas, Korjak-Kamchatka.

Revised diagnosis: Middle-sized, slightly compressed shell with a rapid whorl increase. Umbilicus is very shallow. Whorl section is nearly ovate with slightly convex flanks, an evenly rounded venter and low, inclined umbilical walls. The maximum breadth is above the narrowly rounded umbilical shoulder. The shell surface is ornamented with ribs, fine striae and rare constrictions. They bend forwards near the umbilicus and become radial above mid-flank. The ribs are single (or extremely rarely bifurcating near mid-flank), strongly developed near the umbilical edge and gradually decreased towards the venter.

Measurements:

	D	H	B	U	B/H
NEIM 22s/857-1/3	30,2	14,4 (.48)	10,4 (.34)	5,5 (.18)	0,72
NEIM 22s/853-1/1	47,0	24,0 (.51)	–	7,2(.15)	–
NEIM 22s/8619-4/1	56,5	28,7(.51)	18,1(.32)	9,8(.17)	0,17

Comments: The species grades morphologically into the later form *Freboldiceras singulare* IMLAY, from which it differs by more compressed shell, an absence of intercalated secondary ribs and an extremely rare occurrence of bifurcating ribs.

Occurrence: The species has been collected from the lowermost Albian beds of Korjak-Kamchatka, NE Russia and is known from the *schrammeni* subzone, Lower Albian, of North Greenland and Spitsbergen.

Subfamily Beudanticeratinae BREISTROFFER, 1953
Genus *Beudanticeras* HITZEL, 1905

Type-species: *Ammonites beudanti* BRONGNIART, 1822.

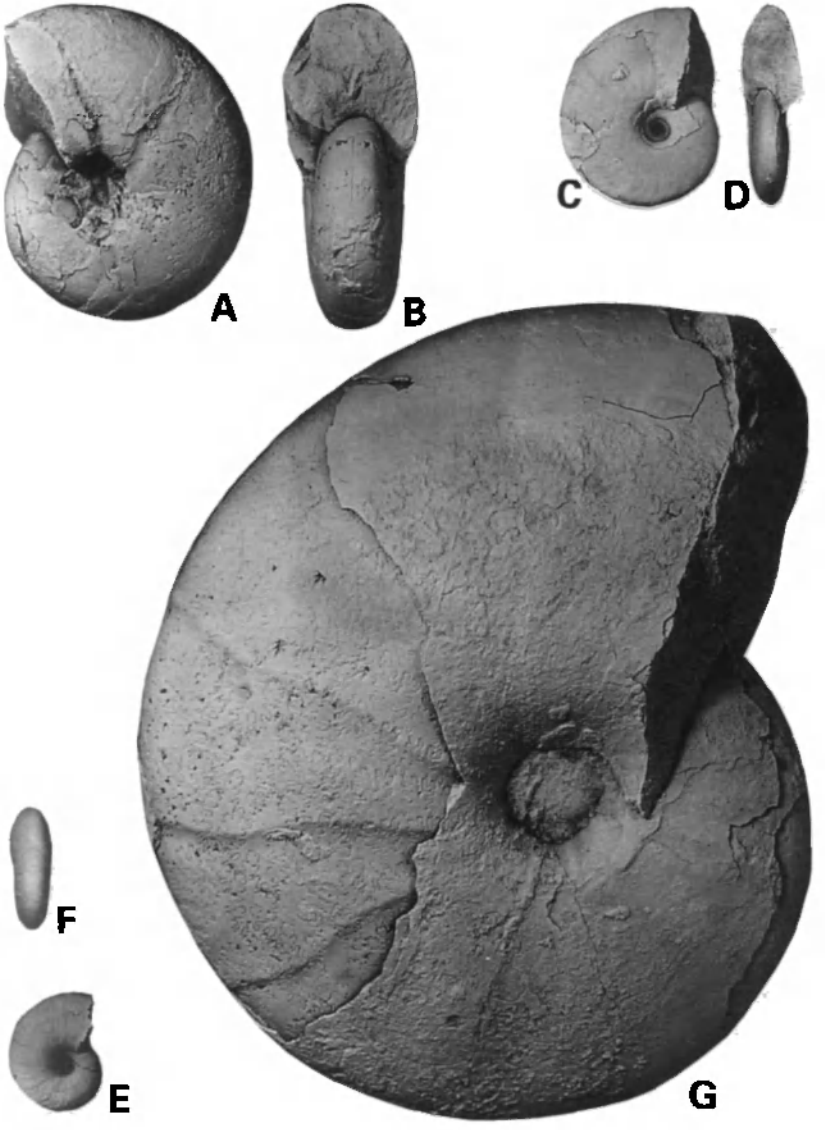

Fig. 4. Suborder Ammonitina, family Desmoceratidae. **A, B** - *Desmoceras (Pseudouhligella) japonicum* YABE; NEIM 22s/2667, Lower Cenomanian, Niklekujul River. **C-G** - *Beudanticeras* aff. *B. arduennense* BREISTROFFER; **C-F** - GPIT 1736/5, /6, Lower Albian, *Parasilesites* spp. subzone, Ajnyn River; **G** - NEIM 22s/8617-1, Lower Albian, *Parasilesites* spp. subzone, Kruglokamennaja River.

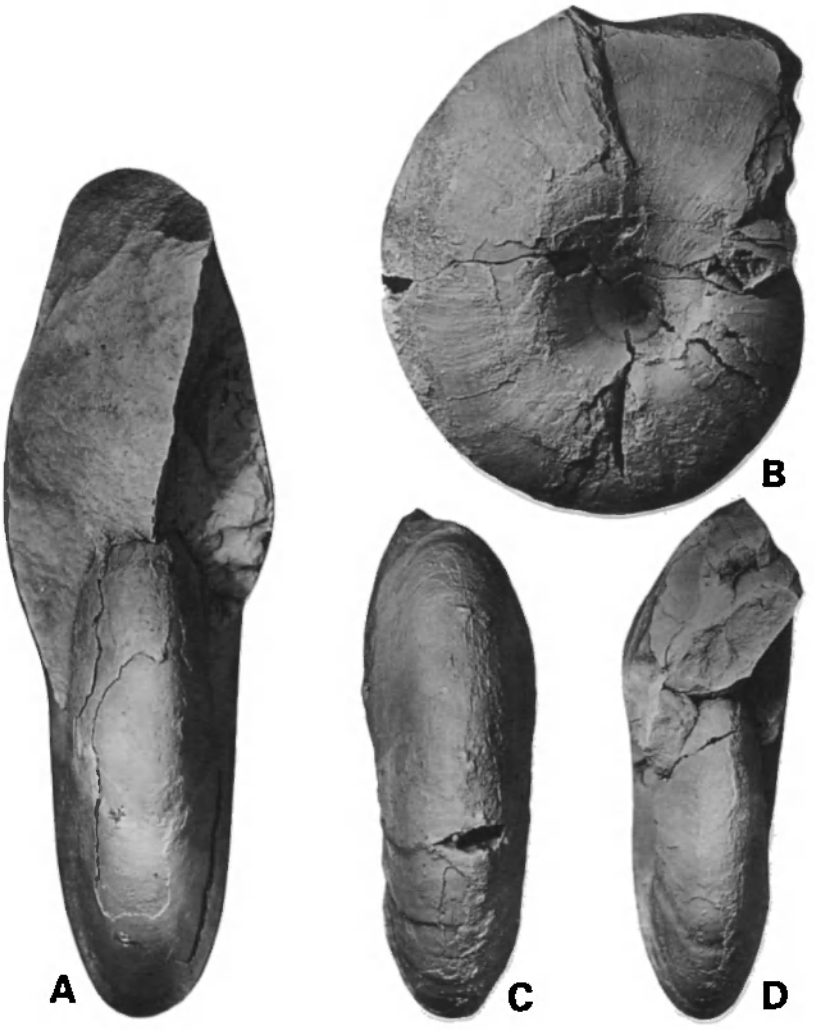

Fig. 5. Family Desmoceratidae. **A** - *Beudanticeras* afl. *B. arduennense* BREISTROFFER; NEIM 22s/8617-1, Lower Albian, *Parasilesites* spp. subzone, Kruglokamennaja River. **B-D** - *Grantziceras affine* (WHITEAVES); GPIT 1736/7, Lower Albian, Ajnyn River.

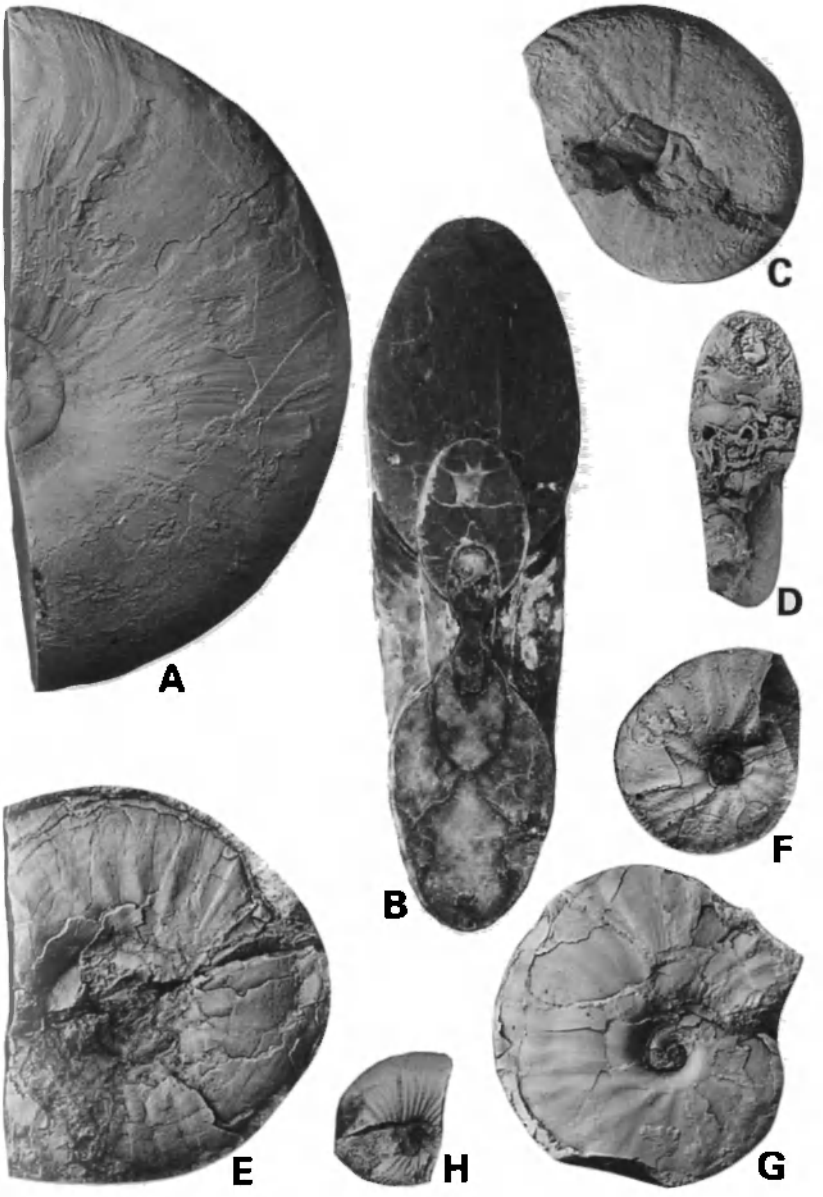

Fig. 6. Family Desmoceratidae. **A, B** - *Grantziceras affine* (Whiteaves); NEIM 22s/8522-5, Middle Albian, Anjyn River. **C, D** - *Puzosia skidegatensis* McLearn; GPIT 1736/8, Middle Albian, Main basin. **E-G** - *Freboldiceras praesingulare* Birkelund & Håkansson; E - GPIT 1736/9, lowermost Albian, Main basin; **F, G** - NEIM 22s/857-11, /857-13, lowermost Albian, Ajnyn River. **H** - *Kennicottia bifurcata* Imlay; GPIT 1734/1, lowermost Albian, Main basin.

Beudanticeras aff. *B. arduennense* BREISTROFFER
Figs. 4 C-G; 5 A

Material: 11 specimens of a good preservation from middle part of the *Arcthoplites (Subarcthoplites) talkeetnanus* Zone, Lower Albian Ajnyn and Main areas, Korjak-Kamchatka.

Measurements:

	D	H	B	U	B/H
GPIT 1736/1	29,5	15,0 (.51)	8,4 (.28)	5,0(.17)	0,56
NEIM 22s/854-3	178,0	82,5 (.46)	61,7 (.35)	29,7 (.17)	0,75

Comments: The specimens show resemblance to both *Beudanticeras arduennense* BREISTROFFER (see CASEY, 1961, p. 156, pl. 27, fig. 1, pl. 28, figs. 9-11), which ranges from the *kitchini* to the *puzosianus* subzones of Europe, from which they differ by sloped umbilical walls, only and *Grantziceras affine* (WHITEAVES) (Figs. 5 B, D; 6 A, B), but differ by a higher whorl section with maximum breadth below mid-flank, and an absence of the crowded fine striae on the less convex flanks.

Occurrence: These forms have been collected from a narrow stratigraphical interval in the base of *Parasilesites* spp. subzone, Lower Albian, in the Ajnyn and the Main areas, but are still unknown in the intermediate Penzhina area.

Superfamily Hoplitaceae H. DOUVILLÉ, 1890
Family Hoplitidae H. DOUVILLÉ, 1890
Subfamily Cleoniceratinae WHITEHOUSE, 1926
Genus *Cleoniceras* PARONA & BONARELLI, 1897

Type-species: *Ammonites cleon* d'ORBIGNY, 1850 (= *A. bicurvatoides* d'ORBIGNY, non MICHELIN).

Subgenus *Cleoniceras s. s.*
Cleoniceras aff. *Cl. (Cl.) leightonense* SPATH
Figs. 8 A, B

1988 *Grycia dubia* (MIKHAILOVA & TEREKHOVA). – ALABUSHEV & ALABUSHEVA, pl. 2, fig. 3, non fig. 2 = *Anadesmoceras strangulatum* CASEY.

Material: Single specimen from the *Arcthoplites (Subarcthoplites) talkeetnanus* Zone, Lower Albian; Ajnyn area, western Korjak-Kamchatka.

Measurements:

	D	H	B	U	B/H
NEIM 22s/857-3/3	31,7	16,5 (.52)	8,9 (.28)	4,8 (.15)	0,54

Comments: The specimen is most similar to the holotype (BM C40132) of *Cl. leightonense* (SPATH) (1942, p. 701, text-figs. 247a-b), from which it differs by less number of ribs and longer umbilical bullae. It differs from indistinctly ribbed specimens of *Cl. floridum* CASEY, e. g. BM C84755 (D = 43 mm) from *mammillatum* Superzone, by a complete absence of intercalated ribs.

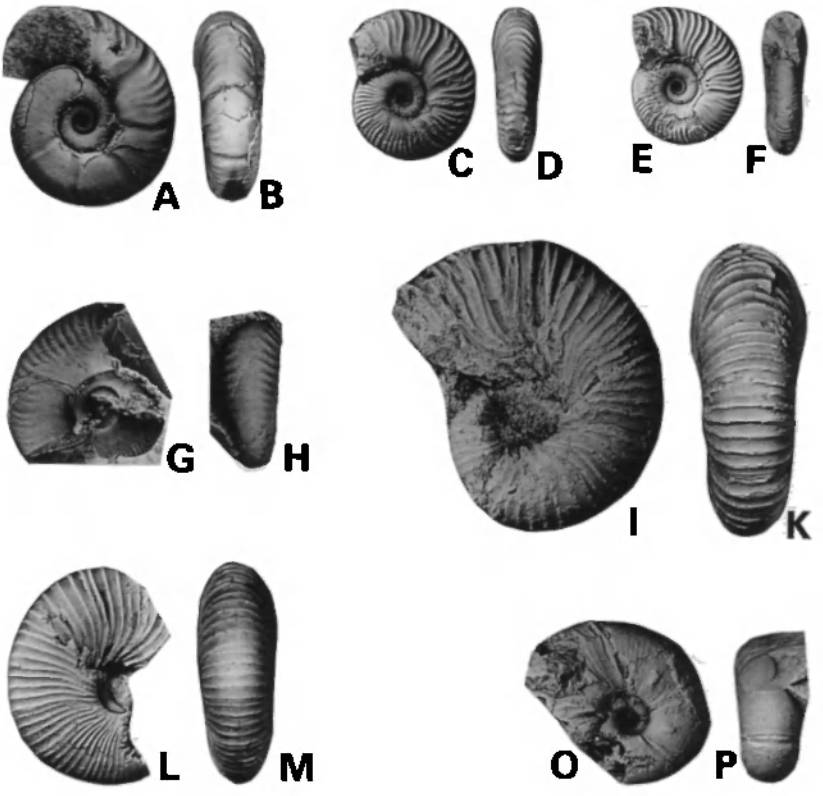

Fig. 7. Families Silesitidae and Kossmaticeratidae. **A, B** - *Parasilesites bullatus* IMLAY; NEIM 22s/7-4, Lower Albian, Ajnyn River. **C-F** - *Parasilesites laperousianus* (WHITEAVES); GPIT 1736/10, /11, Lower Albian, Main basin. **G, H** - *Hulenites* sp.; NEIM 22s/7-2, lowermost Albian, Ajnyn River. **I, K** - *Marshallites cumshewaensis* (WHITEAVES); NEIM 22s/11-4, Upper Albian, Ajnyn River. **L, M** - *Marshallites columbianus* MCLEARN; NEIM 22s/7844-1, Upper Albian, Ajnyn River, **O, P** - *Eogunnarites unicus* (YABE); NEIM 22s/7110, lowermost Cenomanian, Ajnyn River.

Genus *Anadesmoceras* CASEY, 1954

Type-species: *Anadesmoceras strangulatum* CASEY, 1954.

Anadesmoceras strangulatum CASEY
Figs. 9 D-G

1954 *Anadesmoceras strangulatum*. – CASEY, p. 107, text-figs. 2a, b.

1966 *Anadesmoceras strangulatum* CASEY. – CASEY, p. 576, pl. 96, figs. 3, 4, pl. 97, figs. 2, 4, 5, text-figs. 218b, f.

1988 *Grycia dubia* (MIKHAILOVA & TEREKHOVA). – ALABUSHEV & ALABUSHEVA, pl. 2, fig. 2, non fig. 3 = *Cleoniceras* aff. *Cl. (Cl.) leightonense* SPATH.

1988 *Grantziceras glabrum* (WHITEAVES). – ALABUSHEV & ALABUSHEVA, p. 8, pl. 1, figs. 3a, b.

Holotype: Specimen BGS Zm 1283 from the top of *tardefurcata* Zone (*regularis* subzone), Lower Greensand, of southern England, figured by CASEY (1954, text-figs. 2a, b).
Material: 5 well-preserved specimens from the lower part of *Arcthoplites (Subarcthoplites) talkeetnanus* Zone, Lower Albian; Ajnyn and Penzhina areas, western Korjak-Kamchatka.

Revised diagnosis: Discoidal mid-sized shell with a high expansion rate. The flanks are gently convex and convergent in the youth, and flattened subparallel in the adult. Umbilicus narrow, with steeply sloped walls and distinct sharply rounded shoulder. Shell surface ornamented, mostly, by sigmoidal fine striae. Juvenile whorls show several (8 to 12) elongate indistinct subcostae on the outer half of the flanks. Rare constrictions (1 to 3) developed on the adult body chamber.

Measurements:

	D	H	B	U	B/H
NEIM 22s/857-5/1	21,2	9,8 (.46)	5,3 (.25)	3,1 (.15)	0,54
NEIM 22s/858-1/4	53,7	26,4 (.49)	14,3 (.27)	7,6 (.14)	0,54
NEIM 22s/156-1/3	91,4	45,0 (.49)	23,8 (.26)	13,9 (.15)	0,53

Comments: Some of the specimens from Korjak-Kamchatka (e. g. Fig. 9 D) demonstrate noteworthy resemblance with the type specimens, for instance, with paratype BGS Zm1290 (D = 45 mm). Juvenile representatives of the species (Figs. 9 E, H) are very close to the specimen BM C72496 (D = 28 mm) from the *farnhamensis* subzone, basal Albian, of Coxbridge, England, which has been identified earlier as *A.* aff. *A. costatum* CASEY (1966, p. 579). The species described above differs from, *A. subbaylei* (SPATH) (Figs. 9 B, C; 10 A) by a complete absence of subcostae on the inner half of flanks.
Occurrence: Collected from the lower part of the *Arcthoplites (Subarcthoplites) talkeetnanus* Zone, Lower Albian, of western Korjak-Kamchatka, NE Russia. Known from the *regularis* subzone, Lower Albian, of southern England.

Subfamily Gastroplitinae WRIGHT, 1952
Genus *Arcthoplites* SPATH, 1925
Subgenus *Subarcthoplites* CASEY, 1954
(= *Bellidiscus* SAVEL'EV, 1973)

Type species: *Lemuroceras belli* MCLEARN, 1945.
Comments: The subgenus includes moderately compressed forms differing from nominal subgenus by ribs, which are high, sharp, gently flexuous on the flanks and curved forward with reducing in strength on the venter; and by nearly smooth body chamber on the adult stage.

Arcthoplites (Subarcthoplites) talkeetnanus (IMLAY)
Figs. 10 F-K

1960 *Lemuroceras talkeetnanum*. – IMLAY, p. 109, pl. 18, figs. 34-41.
1961 *Subarcthoplites talkeetnanus* (IMPLAY). – CASEY, p. 167 (footnote).
1964 *Arcthoplites* aff. *A. jachromensis* (NIKITIN). – JELETZKY, p. 78, fig 1.

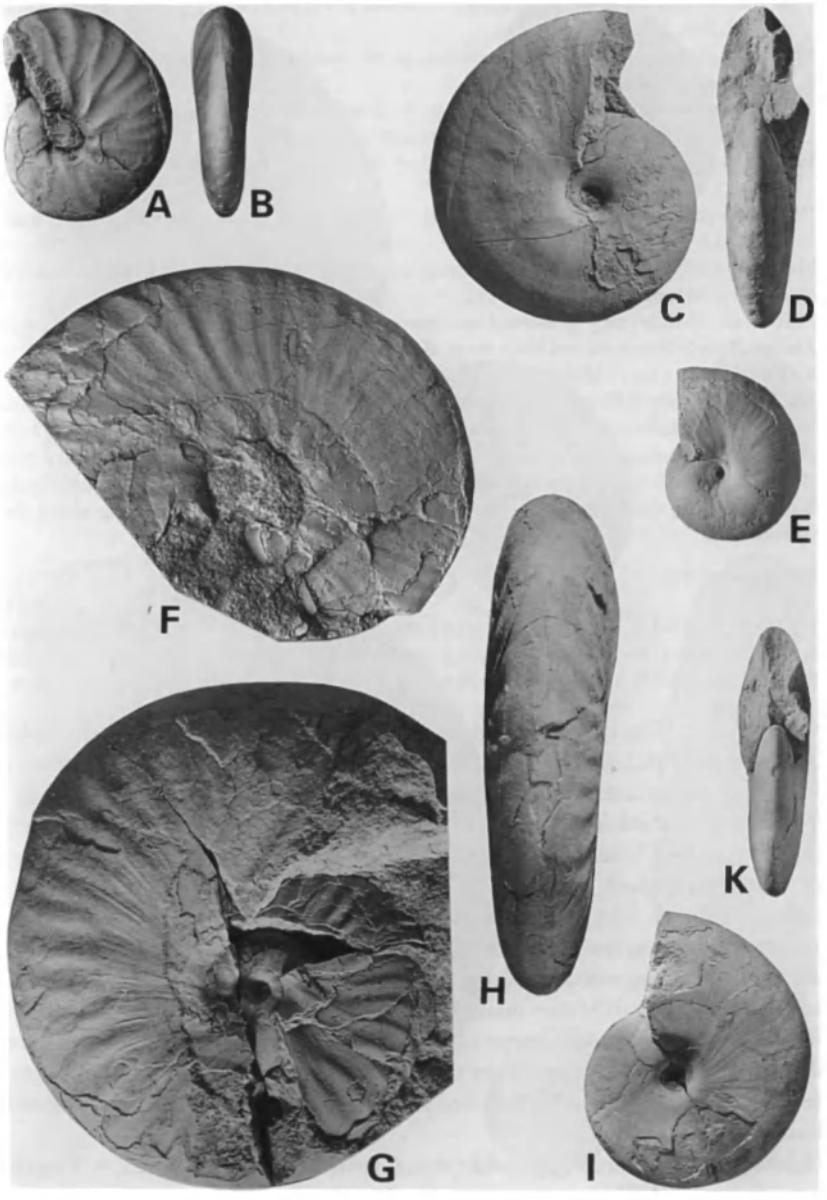

Fig. 8. Family Hoplitidae. **A, B** - *Cleoniceras* aff. *Cl. (Cl.) leightonense* SPATH; NEIM 22s/857-33, Lower Albian, Ajnyn River. **C-E** - *Cleoniceras (Grycia) dubium* MIKHAILOVA & TEREKHOVA; **C, D** - GPIT 1736/12, Middle Albian, Main basin; **E** - GPIT 1736/13, Lower Albian, Ajnyn River. **F-H** - *Cleoniceras (Grycia) perezianum* (WHITEAVES); F - GPIT 1736/14, Middle Albian, Main basin; **G, H** - GPIT 1736/15, Middle Cenomanian, Niklekujul River. **I, K** - *Cleoniceras (Grycia) susukii* MURPHY & RODDA; GPIT 1736/16, Middle Albian, Main basin.

1967 *Arcthoplites talkeetnanus* (IMLAY). – JONES, p. 39, pl. 7, figs. 26-31, pl. 8, figs. 1-18, pl. 9, figs. 1, 2, text-figure 19.

1974 *Cymahoplites caseyi*. – MIKHAILOVA, p. 39, text-fig. 2, non text-fig. 1 = *Cymahoplites caseyi* MIKHAILOVA.

1983 *Arcthoplites jachromensis* (NIKITIN). – BIRKELUND & HÅKANSSON, p. 18, pl. 2, figs. 8-10, non figs. 1-7 = *Arcthoplites jachromensis* (NIKITIN).

1988 *Subarcthoplites talkeetnanus* (IMLAY). – ALABUSHEV & ALABUSHEVA, p. 24, pl. 2, figs. 5, 6.

1994 *Subarcthoplites talkeetnanus* (IMLAY). – ALABUSHEV & WIEDMANN (1994b), text-fig. 4D.

Holotype: Specimen USNM 13015 from upper Lower Albian beds of Alaska, figured by IMLAY (1961, pl. 18, figs. 34, 37-39).

Material: 14 differently preserved specimens from the Zone of the same name, Lower Albian; Ajnyn, Penzhina and Main areas, Korjak-Kamchatka.

Revised diagnosis: Middle-sized shell with whorl of oval to subquadrate section. Flanks are slightly inflated, venter is broadly rounded. Moderately wide umbilicus with inclined walls and evenly rounded shoulder. Surface ornamented by primary ribs (12-15 per whorl) springing from elongate umbilical swelling or bullae and by secondary ribs (15-22 per whorl) spliting from primary ones or arising freely just below the mid-flank. Both ribs cross the venter with distinct forward projection and weakening along the siphonal line.

Measurements:

	D	H	B	U	B/H
NEIM 22s/8515-1/6	32,4	15,9 (.49)	13,0 (.40)	7,2 (.20)	0,81
NEIM 22s/863-1/2	39,1	16,8 (.43)	13,4 (.34)	8,6 (.22)	0,80
NEIM 22s/6625-2/1	57,5	28,9 (.50)	22,7 (.39)	9,8 (.17)	0,79

Comments: The species is highly variable. It differs from the most similar *A. (S.) belli* (MCLEARN) (Fig. 10 B) by more compressed shell, narrower umbilicus and coarser ribs with more distinct bullae along the umbilical shoulder. This ornamentation is more distinct than that of *A. (S.) mcconnelli* (WHITEAVES) (Figs. 10 C-E). Three specimens from the Lower Albian (*acuticostata* subzone) of North Greenland, identified by BIRKELUND and HÅKANSSON (1983, pl. 2, figs. 8-10) as *A. (A.) jachromensis* (NIKITIN), differ from undoubted representatives of NIKITIN's species (ibidem, pl. 2, figs. 1-7) by its ribbing with distinct forward projection on the venter. The specimen MGU 13455 from the *tardefurcata* Zone of Mangyshlak, Russia, figured by MIKHAILOVA (1974, text-fig. 2) as *Cymahoplites** *caseyi* is, most likely, true representative of above described species. It differs from the typical *C. caseyi* MIKHAILOVA (ibidem, text-fig. 1) by its ovate whorl-section and a presence of the umbilical elongated bullae.

(According to the suture line ontogeny, *Cymahoplites* SPATH, 1925, = *Vnigriceras* SAVEL'EV, 1973).

Occurrence: Known from the Lower Albian of Korjak-Kamchatka, NE Russia. Most numerous in the Lower Albian of Alaska, USA, and Arctic Canada. Extremely rarely distributed in the *tardefurcata* (s. s.) Zone, Lower Albian, of North Greenland and South Russia.

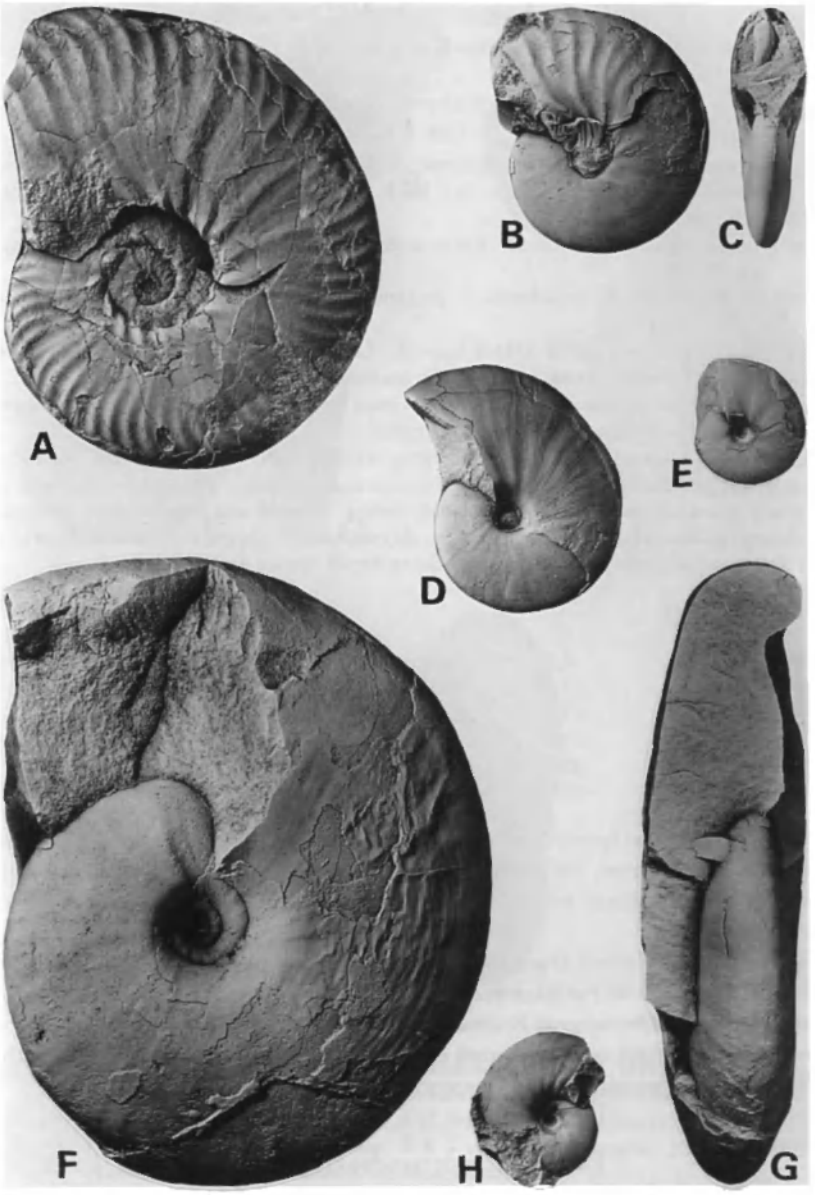

Fig. 9. Family Hoplitidae. **A** - *Lecontettes deansi* (WHITEAVES); NEIM 22s/7-1, lowermost Albian, Ajnyn River. **B, C** - *Anadesmoceras subbaylei* (SPATH); GPIT 1736/17, Lower Albian, Main basin. **D-G** - *Anadesmoceras strangulatum* CASEY; NEIM 22s/857-31, GPIT 1736/18, /19, NEIM 22s/156-13, Lower Albian, Ajnyn River.

Genus *Neogastroplites* McLearn, 1931

Type-species: *Buchiceras? cornutum* Whiteaves, 1885.

Neogastroplites kamchatkensis Alabushev & Wiedmann
Figs. 11 C, D

1988 *Neogastroplites americanus* (Reeside & Weymouth). – Alabushev & Alabusheva, pl. 2, figs. 7a, b, non figs. 8a, b = *Neogastroplites americanus* (Reeside & Weymouth, 1931).

1989 *Neogastroplites americanus* (Reeside & Weymouth). – Alabushev (1989a), text-fig. 11.

1994 *Neogastroplites kamchatkensis*. – Alabushev & Wiedmann (1994 a), p. 70, text-figs. 3 A-L, 4.

Holotype: Specimen GPIT 1733/1 from the Lower Cenomanian of western Korjak-Kamchatka, figured by Alabushev and Wiedmann (1994, text-figs 3A-B).

Material: 18 specimens of different preservation from the Lower Cenomanian; Ajnyn Valley and Main Mountains, Korjak-Kamchatka.

Revised diagnosis: Small-sized, moderately involute shell. Whorls of oval section have narrowly to moderately arched venter and convex flanks. Numerous ribs, 30-36 per whorl, slightly prorsiconcave, sometimes falcoid, having a broad and angular cross-section. Primary ribs few, 12-17 per whorl. One (rarely two) shorter rib(s) are intercalated between or branching from the primary ones. On the venter all ribs are gently projected.

Measurements:

	D	H	B	U	B/H
GPIT 1733/5	4,3	2,4 (.56)	2,7 (.63)	1,0 (.23)	1,13
GPIT 1733/6	11,3	5,5 (.49)	4,4 (.40)	2,4 (.21)	0,80
GPIT 1733/7	23,0	11,5 (.50)	13,0 (.57)	4,5 (.20)	1,13
GPIT 1733/2	31,0	13,0 (.42)	10,0 (.32)	7,3 (.24)	0,77
GPIT 1733/1	32,0	14,0 (.44)	11,0 (.34)	8,0 (.25)	0,79
NEIM 22s/10-1	60,0	33,0 (.55)	26,0 (.43)	9,0 (.15)	0,79

Comments: The species differs from the closely allied *N. americanus* (Reeside & Weymouth) from the Upper Albian of North-East Russia (Figs. 11 A, B) by less numerous ribs without ventrolateral broadening or tubercles, and by wider umbilicus.

Occurrence: Known from the Lower Cenomanian of northwestern Kamchatka (together with *Parajaubertella kawakitana* Matsumoto), Main Mountains (together with *Desmoceras kossmati* Matsumoto and *Mariella (M.) cenomanensis* (Schlüter)) and the eastern coast of Korjak-Kamchatka (together with *Hypoturrilites gravesianus* (d'Orbigny)).

Family Placenticeratidae Hyatt, 1900
Subfamily Rapidoplacenticeratinae Alabushev & Alabusheva, 1988
Genus *Rapidoplacenticeras* Alabushev, 1988

Type-species: *Proplacenticeras sutherlandbrowni* McLearn, 1972.

Generic character: Disk-shaped shell; compressed whorls increase rapidly in height; umbilicus narrow. Shell surface is nearly smooth. Suture line with division of lateral lobe L into three parts $L - L_v L_m L_d$.

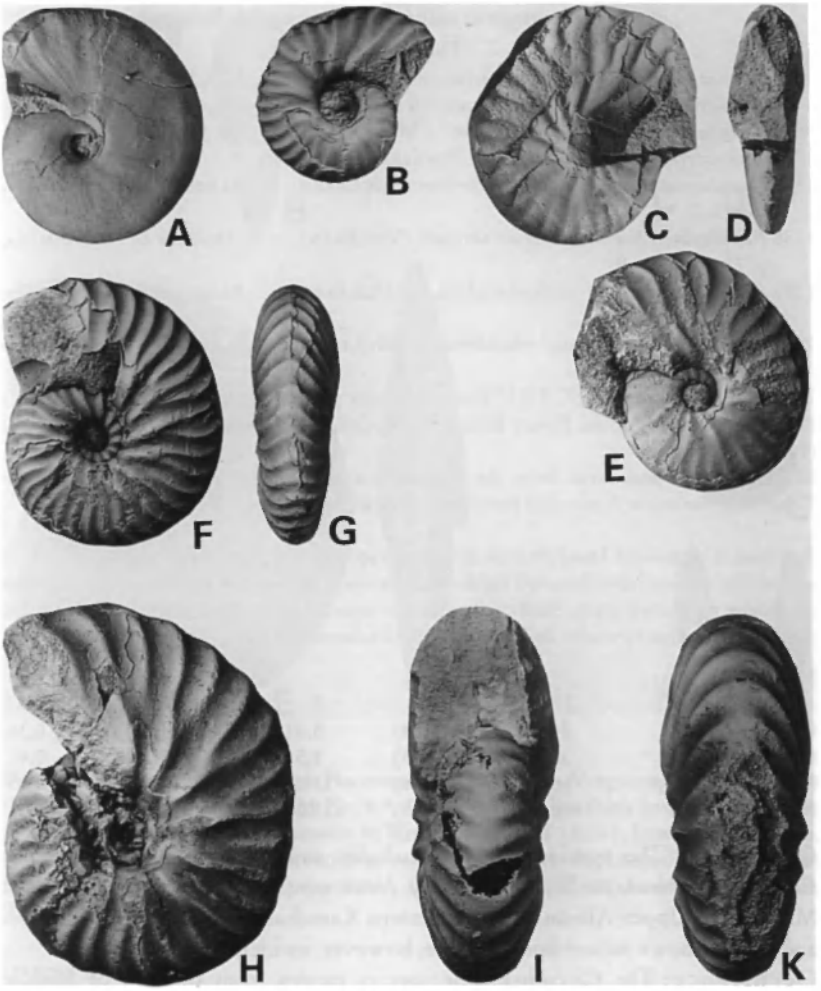

Fig. 10. Family Hoplitidae. **A** - *Anadesmoceras subbaylei* (Spath); GPIT 1736/20, Lower Albian, Niklekujul River. **B** - *Arcthoplites (Subarcthoplites) belli* McLearn; GPIT 1736/21, Lower Albian, Niklekujul River. **C-E** - *A. (S.) mcconnelli* (Whiteaves); GPIT 1736/22, Lower Albian, Kruglokamennaja River. **F-K** - *A. (S.) talkeetnanus* (Imlay); NEIM 22s/863-11, /6625-21, Lower Albian, Kruglokamennaja River.

Rapidoplacenticeras sutherlandbrowni (McLEARN)
Figs. 11 E-I

1959 *Proplacenticeras* sp. – MATSUMOTO, p. 68, pl. 24, fig. 1; pl. 25, fig. 1.
1965 *Proplacenticeras?* sp. – VERESHCHAGIN et al., p. 61, pl. 74, figs. 3, 4.
1972 *Proplacenticeras sutherlandbrowni*. – McLEARN, p. 56, pl. 8, fig. 3.
1987 *Cleoniceras (Neosaynella?)* sp. – POYARKOVA, pl. 23, fig. 7.
1988 *Rapidoplacenticeras sutherlandbrowni* (McLEARN). – ALABUSHEV, p. 110, text-figs. 1, 2.
1988 *Rapidoplacenticeras sutherlandbrowni* (McLEARN). – ALABUSHEV & ALABUSHEVA, p. 28, pl. 2, fig. 9.
1989 *Rapidoplacenticeras sutherlandbrowni* (McLEARN). – ALABUSHEV (1989a), text-figs. 14, 18B.
1994 *Rapidoplacenticeras sutherlandbrowni* (McLEARN). – ALABUSHEV & WIEDMANN (1994b), text-fig. 4 H.

Holotype: Specimen GSC 21227 from the upper part of a sandy horizon of the Haida Formation, Upper Albian, Fleury Island, British Columbia, Canada, figured by McLEARN (1972, pl. 8, fig. 3).

Material: Five specimens from the *Marshallites columbianus* Zone, Upper Albian to Lower Cenomanian; Ajnyn and Penzhina areas, western Korjak-Kamchatka.

Revised diagnosis: Involute shell of medium to large size. Rapidly increasing whorls of arrow-like section have flattened flanks and narrowly rounded venter. Narrow, step-like umbilicus with steep walls. Shell surface almost smooth except for a faint radial and spiral striation and some rare faint and slightly curved subcostae on inner flanks.

Measurements:

	D	H	B	U	B/H
GPIT 1735/68	24,0	13,0 (.54)	5,0 (.21)	3,1 (.13)	0,38
GPIT 1735/69	37,0	20,5 (.55)	8,5 (.23)	4,1 (.11)	0,41
NEIM 22s/2060-4	66,0	37,0 (.56)	13,0 (.20)	6,0 (.09)	0,35
NEIM 22s/2663	116,0	61,0 (.53)	23.0 (.20)	11,0 (.09)	0,38

Comments: The species possibly includes some specimens identified as *Cleoniceras (Neosaynella) discoides* by AVDEIKO (1968) from the uppermost Middle and Upper Albian of northwestern Kamchatka. The short description and the unknown suture line preclude, however, its inclusion here.

Occurrence: The Circum-Pacific species ranges from the top of Middle Albian to the Lower Cenomanian, and occurs in Sakhalin and Korjak-Kamchatka, NE Russia, Alaska, USA, and the Insular Belt of Canada.

6. Conclusions

A – Twenty nine ammonite species have been collected from the Albian to Middle Cenomanian formations of Korjak-Kamchatka, of which 7 poorly known are described and 22 others are only figured in this paper.

B – The oldest diagnostic Albian ammonite fauna is known from basal beds of the Kedrovskaja Formation in the Ajnyn Valley. It includs *Freboldiceras praesingulare*, *Leconteites deansi*, *Anagaudryceras aurarium*, *Grantziceras affine*, and corresponds to the earliest Albian (perhaps, without basal beds).

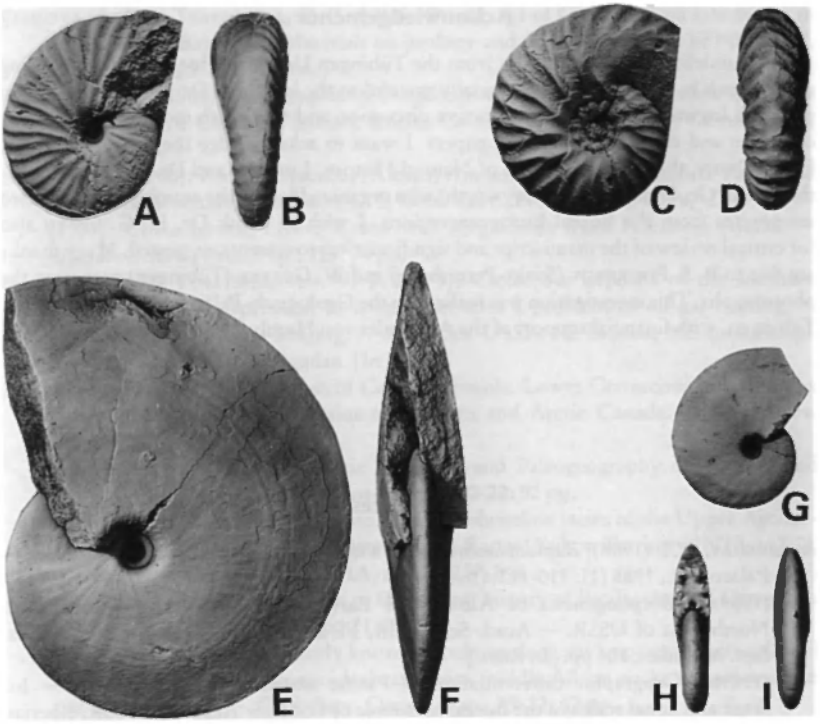

Fig. 11. Families Hoplitidae and Placenticeratidae. **A, B** - *Neogastroplites americanus* (Reeside & Weymouth); NEIM 22s/9-1, Upper Albian, Penzhina basin. **C, D** - *Neogastroplites kamchatkensis* Alabushev & Wiedmann; GPIT 1733/1, Lower Cenomanian, Ajnyn River. **E-I** - *Rapidoplacenticeras sutherlandbrowni* (McLearn); **E-F** - NEIM 22s/2060-4, Upper Albian, Ajnyn River; **G-I** - GPIT 1735/68, Lower Cenomanian, Talovka basin.

C – Five ammonite zones are recognized within the studied Albian to Middle Cenomanian sections (Table 1). The youngest of them - *Turrilites costatus* Zone (Middle Cenomanian) - has an interprovincial character, whereas the others may be used only for long-distance correlation within the North Pacific Realm.

D – The subzones are based on the stratigraphical ranges of easily recognized, but not numerous, species, such as *Anadesmoceras strangulatum, Parasilesites laperousianus, Neogastroplites americanus* and *N. kamchatkensis*.

E – Some taxa, namely: *Anadesmoceras strangulatum, A. subbaylei, Hypoturrilites gravesianus, Mariella (M) cenomanensis* and *Turrilites costatus*, provide biogeographical links between Boreal European and North Pacific faunas.

Acknowledgements

I am indebted to all colleagues from the Tübingen University for the support during my research in Germany. I am especially grateful to the late Prof. Dr. J. WIEDMANN who provided logistical advise and productive discussion and was much more than my senior colleague and co-author for many papers. I want to acknowledge the assistance of Dr. H. G. OWEN, the British Museum of Natural History, London, and Dr. S. TUNNICLIFFE, the British Geological Survey, Keyworth, who organized for me the examination of selected ammonites from the Boreal European regions. I wish to thank Dr. H. G. OWEN also for critical review of the manuscript and significant improvements suggested. Many thanks are due to B. S. POGREBOV (Sankt-Petersburg) and W. GERBER (Tübingen) preparing the photographs. This investigation was realized in the Geologisch-Paläontologisches Institut, Tübingen, with financial support of the Alexander von Humboldt Foundation, Germany.

References

ALABUSHEV, A. I. (1988): *Rapidoplacenticeras* - a new genus of Cretaceous ammonites. – Palaeont. J., **1988** (1): 110-113. [In Russ.]

–,– (1989a): Morphogenesis of Albian and Early Cenomanian Ammonitids from North-East of USSR. – Acad. Sci. USSR, FE Branch, NE Interdiscipl. Sci. Res. Inst. Magadan, 104 pp. [In Russ.]

–,– (1989b): Geographic differentiation of Pacific ammonites in the Albian. – In: Stage and zonal scales of the Boreal Mesozoic of USSR. – Acad. Sci. USSR, Siberian Branch, Inst. Geol. Geophys., Trudy, **722**: 158-162. Nauka, Moscow. [In Russ.]

–,– (1995): Albian-Turonian (Cretaceous) sedimentation at the Pacific slope of north-eastern Russia. – Newsl. on Stratigr. **32**: 27-43; Berlin-Stuttgart.

ALABUSHEV, A. I. & ALABUSHEVA, A. V. (1988): Ammonoidea from the Albian and Lower Cenomanian of North-East of USSR. – Acad. Sci. USSR, FE Branch, NE Interdiscipl. Sci. Res. Inst., Magadan, 41 pp. [In Russ.]

ALABUSHEV, A. & WIEDMANN, J. (1994a): A new ammonite, *Neogastroplites kamchatkensis*, from the Lower Cenomanian (Cretaceous) of North East Russia (with comments on related forms). – N. Jb. Geol. Paläont., Mh., **1994**: 65-74; Stuttgart.

–,– (1994b): Palaeogeographic significance of the distribution of Albian (Cretaceous) ammonite faunas in the Pacific coast of North-East Russia. – N. Jb. Geol. Pal., Mh., **1994**: 193-204; Stuttgart.

ANDERSON, F. M. (1938): Lower Cretaceous deposits in California and Oregon. – Geol. Soc. Amer., Spec. Pap., **16**: 339 pp.

AVDEIKO, G. P. (1968): Lower Cretaceous deposits of North of the Pacific Ring. – Nauka, Moscow, 136 pp. [In Russ.]

BIRKELUND, T. & HÅKANSSON, E. (1983): The Cretaceous of North Greenland - a stratigraphic and biogeographical analysis. – Zitteliana, **1983** (10): 7-25.

CASEY, R. (1954): New genera and subgenera of Lower Cretaceous ammonites. – J. Washington Acad. Sci., **1954** (44): 106-115.

–,– (1961): A monograph of the Ammonoidea of the Lower Greensand. – Monogr. Palaeontogr. Soc., Pt. III: 119-216.

–,– (1966): A monograph of the Ammonoidea of the Lower Greensand. – Monogr. Palaeontogr. Soc. Pt. VII: 547-582.

Efimova, A. F. & Terekhova, G. P. (1966): On the age of Ginterovskaja Formation in the Ugol'naja Bay. – In: Materials on geology and mineral resources of NE USSR, Magadan. **19**: 63-76. [In Russ.]

Haggart, J. W. (1986): Stratigraphic investigations of the Cretaceous Queen Charlotte Group, Queen Charlotte Islands, British Columbia. – Geol. Surv. Canada, Pap., **86-20**: 24 pp.

Imlay, R. W. (1960): Early Cretaceous (Albian) Ammonites from the Chitina Valley and Talkeetna Mountains, Alaska. – U. S. Geol. Surv., Prof. Pap., **354D**: 87-114.

–,– (1961): Characteristic Lower Cretaceous Megafossils from Northern Alaska. – US. Geol. Surv., Prof. Pap., **335**: 74 pp.

Ivanov, V. V. & Pokhialaynen, V. P. (1973): Cretaceous deposits of the southern part of Penzhina depression in connection with a problem of oil-gas-bearing. – In: Problems of oil-gas-bearing. – Acad. Sci. USSR, FE Branch, NE Interdiscipl. Sci. Res. Inst.: 70-107; Magadan. [In Russ.]

Jeletzky, J. A. (1964): Illustrations of Canadian fossils. Lower Cretaceous marine index fossils of the sedimentary basins of Western and Arctic Canada. – Geol. Surv. Canada, Pap., **64-11**: 101 pp.

–,– (1971): Marine Cretaceous Biotic Provinces and Paleogeography of Western and Arctic Canada. – Geol. Surv. Canada, Pap., **70-22**: 92 pp.

–,– (1975): Sharp Mountain Formation (new): A shoreline facies of the Upper Aptian - Lower Albian flysch division, Eastern Keele Range, Yukon Territory (NTS-117-0). – Geol. Surv. Canada, Pap., **75-1A**, no. 52: 237-244.

–,– (1977): Mid-Cretaceous (Aptian to Coniacian) history of Pacific slope of Canada. – Palaeont. Soc. Japan, Spec. Pap., **21**: 97-126.

–,– (1980): New or formerly poorly known, biochronologically important gastroplitinid and cleoniceratinid (Ammonoidea) taxa from middle Albian rocks of mid-western and Arctic Canada. – Geol. Surv. Canada, Pap., **79-22**: 62 pp.

Jeletzky, J. A. & Stelck, C. R. (1981): *Pachygrycia*, a new *Sonneratia*-like ammonite from the Lower Cretaceous (earliest Albian?) of northern Canada. – Geol. Surv. Canada, Pap., **80-20**: 25 pp.

Jones, D. L. (1967): Cretaceous ammonites from the lower part of the Matanuska Formation, Southern Alaska. – U. S. Geol. Surv., Prof. Pap., **547**: 47 pp.

Jones, D. L., Murphy, M. A. & Packard, E. L. (1965): The Lower Cretaceous (Albian) Ammonite Genera *Leconteites* and *Brewericeras*. – U. S. Geol. Surv., Prof. Pap., **503F**: 21 pp.

Kemper, E. (1983): Über Kalt- und Warmzeiten der Unterkreide. – Zitteliana, **1983** (10): 359-369.

Matsumoto, T. (1959): Cretaceous ammonites from the Upper Chitina Valley, Alaska. – Mem. Fac. Sci., Kyushu Univ., (D) **8** (3): 49-90.

McLearn, F. M. (1972): Ammonites of the Lower Cretaceous Sandstone Member of the Haida Formation, Skidegate Inlet, Queen Charlotte Islands, Western British Columbia. – Bull. Geol. Surv., Canada, **188**: 78 pp.

Mikhailova, I. A. (1974): Genus *Cymahoplites* Spath from the Albian of Mangyshlak (Ammonoidea, Hoplitaceae). – Vestnik MGU, **1974** (4): 37-43. [In Russ.]

Mikhailova, I. A. & Terekhova, G. P. (1975): Stratigraphy and fauna of Albian deposits in the Main basin (NE USSR). – Izvestija Akad. Nauk SSSR., (Geol.), **1975** (9): 54-65. [In Russ.]

Murphy, M. A. (1956): Lower Cretaceous stratigraphic units of northern California. – Amer. Assoc. Petrol. Geol., Bull., **40**: 2098-2119.

–,– (1967): Aptian and Albian Tetragonitidae (Ammonoidea) from northern California. – Univ. California, Publ. Geol. Sci., **70**: 32 pp.

MURPHY, M. A. & RODDA, P. U. (1959): New ammonites from the Albian of northern California. – J. Paleont., **33** (1): 103-105.

NAGY, J. (1970): Ammonite faunas and stratigraphy of the Lower Cretaceous (Albian) rocks in southern Spitsbergen. – Skr. norsk. Polarinst., **152**: 58 pp.

OWEN, H. G. (1988): Correlation of Ammonite Faunal Provinces in the Lower Albian (mid-Cretaceous). – In: WIEDMANN, J. & KULLMANN, J. (eds.): Cephalopods - Present and Past: 477-489; Stuttgart.

PARAKETSOV, K. V., POKHIALAYNEN, V. P. & TEREKHOVA, G. P. (1974): Cretaceous biostratigraphy of the Anadyr'-Korjak region. – In: Main problems of biostratigraphy and palaeontology of NE USSR. Pt. 2. Mosozoic: 196-227; Magadan. [In Russ.]

PERGAMENT, M. A. (1961): Stratigraphy of the Upper Cretaceous deposits of northwestern Kamchatka (Penzhina region). – Acad. Sci. USSR, Geol. Inst., Moscow, Trudy **39**: 146 pp. [In Russ.]

–,– (1965): Inocerams and stratigraphy of Early Cretaceous of the North-West of the Pacific Realm. – Izvestija Akad. Nauk SSSR, (Geol.), **1965** (3): 104-114. [In Russ.]

–,– (1977): Stratigraphy and correlation of Mid-Cretaceous of the USSR Pacific regions. – Palaeont. Soc. Japan, Spec. Pap. **21**: 85-95.

POKHIALAYNEN, V. P. (1985): Albian-Cenomanian Mollusks of Mowry basin and his analogies at the North Pacific Ocean. – J. Tikhookeanskaja geologia. **1985** (5): 15-22. [In Russ.]

POKHIALAYNEN, V. P. & TEREKHOVA, G. P. (1984): Heteromorphic ammonites *Shasticrioceras* and *Pseudhelicoceras* from Cretaceous deposits of northwestern Kamchatka. – In: Paleontology and biostratigraphy of Korjak Upland. – Acad. Sci. USSR, FE Branch, NE Interdiscipl. Sci. Res. Inst., Magadan: 54-63. [In Russ.]

POYARKOVA, Z. N. (ed.) (1987): Reference section of Cretaceous deposits in Sakhalin (Naiba section). – Nauka, Leningrad, 196 pp. [In Russ.]

SAVEL'EV, A. A. (1973): Stratigraphy and ammonites of the Lower Albian of Mangyshlak (Zones *Leymeriella tardefurcata* and *Leymeriella regularis*). – VNIGRI, Leningrad, Trudy, **323**: 339 pp. [In Russ.]

SPATH, L. F. (1942): A Monograph of the Ammonoidea of the Gault. – Palaeontogr. Soc. London, Pt. **15**: 669-720.

STELCK, C. R., WALL, J. H., BAHAN, W. G. & MARTIN, L. J. (1956): Middle Albian Foraminifera from Athabasca and Peace River drainage areas of Western Canada. – Research Council of Alberta, Report **75**: 60 pp.

TEREKHOVA, G. P. (1969): On the lower zone of Cenomanian stage in Anadyr'-Korjak region. – In: Inoceramids of Jurassic and Cretaceous of North-Eastern USSR. – Acad. Sci. USSR, FE Branch, NE Interdiscipl. Sci. Res. Inst. 163-172; Magadan. [In Russ.]

–,– (1972): On some uncoil Lower Cretaceous ammonites of North-East USSR. – Mat. geol. min. resources NE USSR **20**: 200-210; Magadan. [In Russ.]

TEREKHOVA, G. P. & BASOV, I. A. (1972): Finds of the Albian and Valanginian redeposited faunas in the Main basin. – Mat. geol. min. resources NE USSR **20**: 227-233; Magadan. [In Russ.]

TEREKHOVA, G. P. & DUNDO, O. P. (1987): Regional stratigraphy of the Anadyr'-Kamchatka region. – In: SOKOLOV, B. S. (ed.): Stratigraphy of USSR, Pt. 2: 137-153; Nedra, Moscow. [In Russ.]

TEREKHOVA, G. P. & MIKHAILOVA, I. A. (1977): Stratigraphy of the Cenomanian deposits of Anadyr'-Korjak region and the findings of ammonite genera *Turrilites* and *Hypoturrilites*. – Acad. Sci. USSR, Izvestija, (Geol.), **1977** (1): 50-60. [In Russ.]

VERESHCHAGIN, V. N. (1977): Cretaceous system of Far East. – Nedra, Leningrad, 242 pp. [In Russ.]

VERESHCHAGIN, V. N., KINASOV, V. P., PARAKETSOV, K. V. & TEREKHOVA, G. P. (1965): Field atlas of Cretaceous fauna of North East USSR. – Magadan, 216 pp. [In Russ.]

Bei der Tübinger Schriftleitung eingegangen am 15. Juli 1994.

Anschrift des Verfassers:

Dr. ALEXEY ALABUSHEV, Alexander von Humboldt Foundation fellow, Geologisch-Paläontologisches Institut der Universität, Sigwartstraße 10, D-72076 Tübingen, Germany. Ab September 1994: American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, USA.