ТРЕТИЙ МЕЖДУНАРОДНЫЙ СИМПОЗИУМ
ПО КЕМБРИЙСКОЙ СИСТЕМЕ

THIRD INTERNATIONAL SYMPOSIUM ON THE
CAMBRIAN SYSTEM

ПУТЕВОДИТЕЛЬ ЭКСКУРСИИ ПО РЕКАМ АЛДАНУ И ЛЕНЕ

СИБИРСКАЯ ПЛАТФОРМА

GUIDBOOK FOR EXCURSION ON THE ALDAN AND LENA RIVERS

SIBERIAN PLATFORM

НОВОСИБИРСК 1990
NOVOSIBIRSK 1990


III · INTERNATIONAL SYMPOSIUM · CAMBRIAN SYSTEM ·
USSR NOVOSIBIRSK 1990

ACADEMY OF SCIENCES OF THE USSR
SIBERIAN BRANCH
INSTITUTE OF GEOLOGY AND GEOPHYSICS
PALAEONTOLOGICAL INSTITUTE

MINISTRY OF GEOLOGY USSR
SIBERIAN RESEARCH INSTITUTE OF GEOLOGY,
GEOPHYSICS AND MINERAL RESOURCES

GUIDBOOK FOR EXCURSION ON THE ALDAN AND LENA RIVERS SIBERIAN PLATFORM

NOVOSIBIRSK 1990

АКАДЕМИЯ НАУК СССР
СИБИРСКОЕ ОТДЕЛЕНИЕ
ИНСТИТУТ ГЕОЛОГИИ И ГЕОФИЗИКИ
ПАЛЕОНТОЛОГИЧЕСКИЙ ИНСТИТУТ

МИНИСТЕРСТВО ГЕОЛОГИИ СССР
СИБИРСКИЙ НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ИНСТИТУТ
ГЕОЛОГИИ, ГЕОФИЗИКИ И МИНЕРАЛЬНОГО СЫРЬЯ

ПУТЕВОДИТЕЛЬ ЭКСКУРСИИ ПО РЕКАМ АЛДАНУ И ЛЕНЕ СИБИРСКАЯ ПЛАТФОРМА

НОВОСИБИРСК 1990

УДК 551.732.2 (571.5)

Асташкин В.А., Варламов А.И., Есакова Н.В., Журавлев А.Ю., Репина Л.Н., Розанов А.Ю., Федоров А.Б., Шабанов Ю.Я. Путеводитель экскурсии по рекам Алдану и Лене. Сибирская платформа. Третий междунар. симпоз. по кембрийской системе; Новосибирск/ АН СССР, Сиб. отд-ние, Ин-т геологии и геофизики; Отв. ред. А.Ю.Журавлев, Л.Н.Репина. Новосибирск, 1990. 115 с.

В краткой форме излагаются история становления ярусной шкалы нижнего кембрия в СССР и особенности геологического строения района стратотипов нижнекембрийских ярусов, расположенного на северном склоне Алданской антеклизы Сибирской платформы. Приводятся описания типовых разрезов ярусов и зон нижнего кембрия, вскрывающихся по берегам рек Алдана и Лены, в их среднем течении. Дается общая характеристика ярусов нижнего кембрия СССР.

Материал представляет интерес для геологов и палеонтологов, изучающих отложения кембрия и верхнего докембрия.

Astashkin V.A., Varlamov A.I., Esakova N.V., Zhuravlev A.Yu., Repina L.N., Rozanov A.Yu., Fedorov A.B., Shabanov Yu.Ya. Guide on Aldan and Lena Rivers. Siberian Platform. Third International Symposium on Cambrian System; Novosibirsk / Academy of Sciences of the USSR, Siberian Branch, Institute of Geology and Geophysics; Editors-in-chief A.Yu.Zhuravlev, L.N.Repina. Novosibirsk, 1990.

Record of development of Cambrian stage subdivision in the U.S.S.R. and special peculiarities of geological structure of the region of stratotypes for Lower Cambrian stages occupying the northern slope of the Aldan Anteclise of the Siberian Platform is briefly outlined. Descriptions of type sections of Lower Cambrian stages and zones outcropped on the banks of the Aldan and Lena Rivers, in their middle stream, are recorded. General outlines of the USSR Lower Cambrian stages are given.

Печатается с авторского оригинала.

RECORD OF DEVELOPMENT OF THE USSR
LOWER CAMBRIAN STAGE SUBDIVISION SCALE

This guide on type sections of Siberian Lower Cambrian stages (the Aldan and Lena Rivers) is already the third one after the "Guide..." 1973 published for the First International Excursion of the Working Group on Precambrian-Cambrian Boundary and "Guide..." 1984 (Val'kov et al., 1984)published for an excursion of the 27th International Geological Congress. At present both guides are a bibliographical rarity. But a motive to compile a new third guide was that a wast new material was obtained. It does not greatly change a general conception but makes the sections of the Middle Aldan and Lena Rivers be more correlative.

The data (in volume "Stratigraphy") given in monography "Lower Cambrian Stage Subdivision" (Nauka, 1984, editors A.Yu. Rozanov, B.S.Sokolov) are taken as a basis. The data are expanded by those of recived lately on different groups of fauna (Stepanova, Luchinina, 1982; Fedorov, 1982,1984,1986; Val'kov, 1983,1987; Vasil'eva, 1985; Bengtson et al., 1986; Khomentovsky, Karlova, 1986; Barskov, Zhuravlev, 1988; Debrenne et al., 1988; Vasil'eva, Sayutina, 1988; Ivantsov, 1990).

The first version of a stage subdivision of the Lower Cambrian was adopted by - ISC (Interdepartmental Stratigraphic Committee), USSR in 1959 (Aldanian and Lenian stages) and after that fundamental studies in greater depth were carried out what led to a development of 4-stage scheme of Lower Cambrian subdivision adopted by ISC of the USSR in 1983 (Table 1,2), (see also Spizharski et al., 1986).

A record of development of notions concerning stage subdivision of Lower Cambrian in Siberia and a problem of their global correlation has been described in detail before(Repina et al., 1964; Rozanov, 1966,1973; Rozanov, Sokolov, 1984) and here we gave only a reduced table. It was necessary, as volume and name of stages of the two upper ones had lately undergone some changes, misleading readers, the more so that those differences in interpretation of nomenclature had spread even among English-reading specialists (compare: Hill, 1972; Harland et al., 1982; Paul, Smith, 1984; Hag,Van Eysinga,

Table I.
Development of notions concerning Lower Cambrian stage subdivision of the Siberian Platform.

<table>
<tr><td colspan="4">Aldanian</td><td>Lenian</td><td>ISC Resolution, 1959</td></tr>
<tr><td rowspan="7">Precambrian</td><td colspan="3">Aldanian</td><td>Lenian</td><td>ISC Resolution, 1963</td></tr>
<tr><td colspan="2">Aldanian</td><td>Botomian</td><td>Lenian</td><td>Repina et al., 1964</td></tr>
<tr><td colspan="2">Aldanian</td><td>Botomian</td><td>Lenian</td><td>Khomentovsky, Repina, 1965</td></tr>
<tr><td>Tommotian</td><td>Atdabanian</td><td>Botomian</td><td>Lenian</td><td>Rozanov, Missarzhevsky, 1966; Zhuravleva, Korshunov, Rozanov, 1969; Rozanov <u>et al.</u>, 1969</td></tr>
<tr><td>Aldanian</td><td colspan="2">Botomian</td><td>Lenian</td><td>Konyushkov, 1966</td></tr>
<tr><td>Tommotian</td><td>Atdabanian</td><td>Lenian</td><td>Elankian</td><td>Rozanov, 1973</td></tr>
<tr><td>Tommotian</td><td>Atdabanian</td><td>Botomian</td><td>Toyonian</td><td>ISC Decisions, 1983; Rozanov, Sokolov (eds.), 1984</td></tr>
</table>

Table 2.

Stage scale of Cambrian lower series adopted by Plenum of the USSR Interdepartmental Stratigraphic Committee in May 24,1982 (ISC Decisions..., 1983).

System	Series	Stage	Trilobite Zones	Archaeocyathan Zones
CAMBRIAN	MIDDLE	Amgan C_2am	Schistocephalus	
	LOWER	Toyonian C_1toy	Anabaraspis splendens C_1toy^{spl}	
			Lermontovia grandis C_1toy^{grn}	Beds with Irinaecyathus grandiperforatus
			Bergeroniellus ketemensis C_1toy^{ket}	
		Botomian C_1bot	Bergeroniaspis ornata C_1bot^{orn}	
			Bergeroniellus asiaticus C_1bot^{ast}	
			Bergeroniellus gurarii C_1bot^{gur}	
			Bergeroniellus micmacciformis-Erbiella C_1bot^{mic}	Carinacyathus(=Porocyathus squamosus-Botomocyathus zelenovi C_1bot^{zel}
		Atdabanian C_1atd	Judomia-Uktaspis (Prouktaspis) C_1atd^{jud}	Fansycyathus lermontovae C_1atd^{ler}
				Nochoroicyathus kokoulini C_1atd^{kok}
			Pagetiellus anabarus C_1atd^{anb}	Carinacyathus(=Porocyathus) pinus C_1atd^{pin}
			Fallotaspis C_1atd^{fal}	Leptosocyathus polyseptus-Retecoscinus zegebarti C_1atd^{zeg}
			Profallotaspis jakutensis C_1atd^{jak}	
		Tommotian C_1tom		Dokidocyathus lenaicus-Tumuliolynthus primigenius C_1tom^{len}
				Dokidocyathus regularis C_1tom^{reg}
				Nochoroicyathus(=Aldanocyathus)sunnaginicus C_1tom^{sun}

1987; Cowie, Bassett, 1989 et al.).

Type sections of Siberian Lower Cambrian stages which are on show for the participants of the 3d International Symposium on the Cambrian System present themselves cliff forming, rather easily accessible outcrops. The whole section comprises carbonate rocks of different types, as a rule rich of fauna and flora remains. Here found and described are typical representatives of main Lower Cambrian groups: archaeocyaths, trilobites, brachiopods, molluscs, hyoliths, SSF (small shelly fossils), algae and etc. (Lermontova, 1951; Suvorova, 1956, 1960; Zhuravleva, 1960; Khomentovsky, Repina, 1965; Repina, 1966,1969; Rozanov, Missarzhevsky, 1966; Rozanov et al.,1969; Zhuravleva, Korshunov, Rozanov, 1969; Sysoev, 1972; Meshkova, 1974; Luchinina, 1975; Egorova et al., 1976; Pel'man, 1977; Sokolov, Zhuravleva, 1983 et al.).A diversity of groups of fossils represented here makes it possible to find elements common for almost all the regions of the world. It is, probably, due to a specific palaeogeographic position of the Siberian Platform in the Early Cambrian and extremely favourable conditions for fauna and flora of that time. There is an opinion that the Anabar-Sinsk Facies Region (=Trasitional Zone) was a centre of origin of some groups of Cambrian faunas. Increased correlative ability of Siberian sections is determined by their rather detailed palaeomagnetic data received by Kirschvink (Kirschvink, Rozanov, 1984). Some isotopic and geochemical data are also obtained in the Lena-Alden sections (Ivanovskaya, 1980; Nikolaeva, Arkhipenko, 1981; Nazarov et al., 1983; Magaritz et al., 1986). Several models of a structure of a palaeobasin occupying the southern part of the Siberian Platform were suggested (Savitsky, Astashkin, 1979; Zhuravleva, 1979; Zhuravleva et al., 1983; Khomentovsky, Gibsher, 1983; Astashkin et al., 1984; Nikolaeva et al.,1986, 1987 et al.).

Those sections were visited and repeatedly studied not only by a large number of soviet specialists, but scientists from other countries.

The following specialists took part in preparation of the guide: V.A.Astashkin, A.I.Varlamov, N.V.Esakova, A.Yu. Zhuravlev, L.N.Repina, A.Yu.Rozanov, A.B.Fedorov, Yu.Ya.

Shabanov. A new material kindly given by V.V.Ermak, A.Yu. Ivantsov, Yu.L.Pel'man, E.A.Zhegallo, G.T.Ushatinskaya was also taken into consideration. L.N.Boldyreva translated the guide into English.

GEOLOGICAL STRUCTURE OF THE STRATOTYPE REGION FOR THE U.S.S.R. LOWER CAMBRIAN STAGES

The area within the limits of which some stratigraphic studies on stage subdivision of the Lower Cambrian have being carried out during several decades occupied the south-eastern part of the Siberian Platform. These investigations are mainly focused on Cambrian sections outcropped on the Aldan and Lena Rivers (Figs. 1,2).

Tectonic conditions of the area are also favourable. By its structure this area can be referred to the northern periclinal of the Aldan Anteclise complicated by low amplitudinal domes covering vast territories. Rocks lie almost horizontally here, or with an angle of dip, generally measured by minutes, but seldom degrees; occasionally and locally, even on the wings of structures, angles of dip reach several degrees. There are no large dislocations along the fractures though they are rather abundant sometimes, especially on the Muchatta-Sinyaya rivers area of the Lena River banks. Some of them infilled by basic dykes, others differ by plicate dislocations, sometimes by crushed rocks. In separate distortions an amplitude of vertical dislocation reaches 20-25 m.

Cambrian sediments of northern slopes of the Aldan Anteclise are overlied with sharp disconformity by terrigeneous sediments of the Jurassic age. Upper, Middle and partly Lower Cambrian sediments are considerably cut in the central part of the northern slope in Pre-Jurassic time. Middle Cambrian sediments rest on the north-western and north-eastern slopes of the Aldan Anteclise, Upper Cambrian - on the north-western slope.

The total thickness of Lower Cambrian sediments of the stratotype area is in average 800-1000 m. Deposits represented by carbonate sediments are very variable in facies respect what determines considerable spatial heterogeneity of the area and those difficulties which arise under geological and, especially, stratigraphic studies. Facies diversity and complexity of Cambrian section structure for the area in question are mainly dependent on peculiarities of palaeogeographic

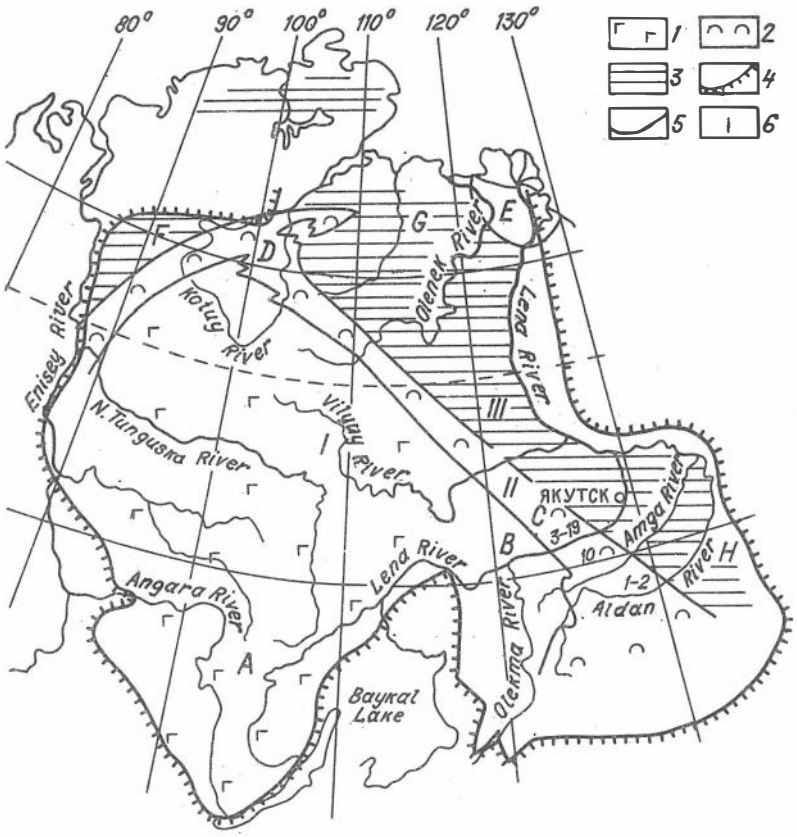


Fig.1. Palaeogeography of the Siberian Platform for Early Cambrian epoch (according to V.E.Savitsky and V.A.Astashkin).
1 - Turukhansk - Irkutsk - Olekma Facies Region:
A - Irkutsk Facies Area (saline basin), B - Olekma Focies Area; II - Anabar - Sinsk Facies Region: C - Sinsk - Botoma, D - Fomich - Arga-Sala and E - Khorbusuonka Facies Areas; III - Yudoma - Olenek Facies Region: F - Igarka - Norilsk, G - Olenek and H - Yudoma - Maya Facies Areas.
1 - deposits of the lagoonal type; 2 - reef deposits; 3 - domanik deposits of the open sea shelf; 4 - Siberian Platform boundary; 5 - reef zone boundary; 6 - type sections and their numbers.

environments existed in the Cambrian palaeobasin on the Siberian Platform.

To understand true peculiarities and evolution of facies composition and thickness of the transitional zone we give a short characteristic of Cambrian section on facies regions.

The Turukhansk-Irkutsk-Olekma Facies Region includes a territory of evaporite sedimentation, i.e. the central, south-western and western regions of the Siberian Platform. Lower Cambrian sediments, within the limits of a vast inner territory of this region, comprise dolostones, sulphates and common salts. Limestones are sparse and have a subordinate development. They occur in the Osa Subhorizon of the Usolka Formation and in the lower subformation of the Litvintsevo Formation. Trilobite fauna are sparse and endemic. Unsufficiently developed algal buildups are recorded in different parts of the section.

While approaching the Anabar-Sinsk Facies Region, salts and then sulphates are gradually disappearing but dolomites dominate. A width of an outer non-saliniferous zone in the section cut by the Lena River is several dozens kilometres. At the same time there is a clear tendency to its widening towards the central regions of the Aldan Shield.

The eastern boundary of the outer non-saliniferous zone of the Turukhansk-Irkutsk-Olekma Facies Region is determined on the Lena River in a Cambrian section by appearance of limestones, algal, algal-archaeocyathan, oolitic-archaeocyathan, oolitic and clastic calcareous fabrics which should be included in the Anabar-Sinsk Facies Region. The boundary between these two regions was gradually displaced towards the North-East of the Siberian Platform during the whole Cambrian (Khomentovsky, Repina, 1965). At the beginning of the Early Cambrian it crossed the Lena River, in the Tolba River mouth area.

At the base of a Cambrian section there is the Yuedey Formation; stratigraphically above it the El'gyan, Tolbachan, Olekma and Chara formations defined in the Lower Cambrian. A Cambrian section of the non-saliniferous zone is topped with the Verkholensk Formation as in the salt-productive part of

the Siberian Platform.In a Lower Cambrian section of an outer non-saliniferous zone a wide development of red-coloured carbonate and argillaceous-carbonate rocks is recorded in the Yuedey and Tolbachan Formations.

The thickness of Cambrian sediments in a non-saliniferous zone is 1000-1500 m.

Within the Yudoma-Olenek Facies Region, occupying a vast territory of the eastern part of the Siberian Platform, a Cambrian section is represented by normal marine facies traced throughout the whole territory. They are characterized by significant prevalence of limestones, abundance and low-diversity of a faunal assemblage that includes some cosmopolitan species of trilobites, brachiopods and other organisms. At the same time algal buildups are feebly developed, archaeocyaths lack.

A Cambrian section of the Yudoma-Olenek Facies Region has a clear three-part subdivision.

The lower half of the Lower Cambrian consists of limestones, argillaceous limestones and marlstones with wide occurrence of red-coloured rocks. This is the Pestrotsvet Formation and its analogues. Judging by data on deep boring, the average thickness of these sediments for the largest part of the region maintains 150-200 m.

A thin unit (about 40-60 m), corresponding to the upper half of the Lower Cambrian and the main part of the Amgan stage of the Middle Cambrian overlies the Pestrotsvet Formation and its analogues. It consists of dark-grey, black limestones, argillaceous limestones, argillaceous and siliceous-argillaceous rocks, usually thin-parallel-bedded, uniquely enriched by scattered organic matter of sapropelic origin. It comprises horizons of fire shales as well. This peculiar unit is very similar to rocks of domanik type and occurs in a vast territory from the basin of the Maya and Yudoma rivers to the Olenek Uplift with a thickness close to the mentioned above.

Sediments of higher stratigraphic level belonging to the upper parts of Amgan and Mayan stages of the Middle Cambrian are represented within the limits of the Yudoma-Olenek Facies

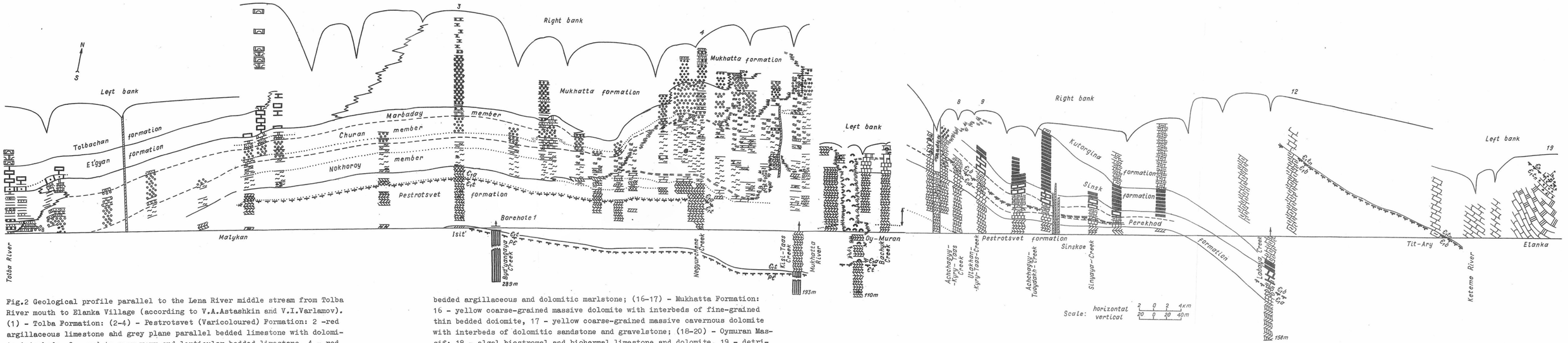


Fig.2 Geological profile parallel to the Lena River middle stream from Tolba River mouth to Elanka Village (according to V.A.Astashkin and V.I.Varlamov). (1) - Tolba Formation: (2-4) - Pestrotsvet (Varicoloured) Formation: 2 -red argillaceous limestone ahd grey plane parallel bedded limestone with dolomite interbeds, 3 - red to grey wavy and lenticular bedded limestone, 4 - red to yellow crossparting argillaceous dolomite; (5) - Yuedey Formation:yellowish grey to red parallel bedded dolomite with interbeds of oolitic dolomite and dolomitic sandstone; (6-8) - Nokhoroy Member; 6 - grey wavy bedded limestone and argillaceous dolomite, 7 - grey flaggy limestone and yellowish grey flaggy argillaceous dolomite, 8 - yellowish grey wavy bedded dolomite;(9-10)-Churan Member: 9 - light yellow oolitic and apoolitic detrital dolomite, 10-alternation of oolitic and fine-grained dolomite; (11-12) - Marbaday Member: 11 - white calcareous sandstone and algal detrital limestone, 12 - yellow to grey parallel bedded thin parting dolomite; (13-14) - Elgyan Formation: 13-yellowish brown weakly bituminous massive cavernous dolomite, 14 - alternation of yellowish grey dolomite and greyish brown limestone; (15) - Tolbachan Formation: alternation of massive stromatolitic dolomite and thin parallel bedded argillaceous and dolomitic marlstone; (16-17) - Mukhatta Formation: 16 - yellow coarse-grained massive dolomite with interbeds of fine-grained thin bedded doiomite, 17 - yellow coarse-grained massive cavernous dolomite with interbeds of dolomitic sandstone and gravelstone; (18-20) - Oymuran Massif: 18 - algal biostromal and biohermal limestone and dolomite, 19 - detrital and taphostromal limestone, 20 - dolomitic (a) and calcareous (b) archaeocyathan - algal bioherm; (21-24) - Perekhod (=Transitional) Formation: 21-Member I: greenish grey to red flaggy argillaceous limestone, 22 - Member II: light bedded limestone, 23 - Member III: light greenish grey to red argillaceous limestone, 24 - Member IY: grey, dark grey to black thin parallel bedded limestone; (25) - Sinsk Formation: dark grey to black bituminous thin mite; (30) - Bachyk key horizon; (31) archaeocyathal-algal and algal dioherm; (32) - dolerite dykes; (33) - fault; (34) stage (a) and belt of reef development (zone of tentative correlation) (b) boundary; (35) formation (a), member (b) and key horizon (c) boundary; (36) Botomian (a) and Toyonian (b) stage index, (37) Tommotian (a) and Atdabanian (b) stage index; (38) - key section number.

Region by the thick (up to 800-900 m), rather simple by composition, limestones, often argillaceous, with subordinate development of mudstones and siltstones (on the eastern slopes of the Aldan Anteclise - the upper part of the Kychic, Ust' Botoma formations and their stratigraphic analogues).

The total thickness of Cambrian sediments of the Yudoma-Olenek Facies Region is 1000-1500 m, thus, it is equal to that of the sediments of the same age in outer non-saliniferous zone of the Turukhansk-Irkutsk-Olekma Facies Region. Inspite of the fact that thickness of the Middle Cambrian in both regions is the same, a thickness of the Amgan Stage in the Yudoma-Olenek Facies Region is considerably lower what is compensated by an increase of thickness of the Mayan Stage.

The Anabar-Sinsk Facies Region separates the Turukhansk-Irkutsk-Olekma and Yudoma-Olenek regions. It is the most complicated geological object. It is within its limits where a complete replacement of evaporites with open marine deposits takes place accompanied by a sharp and significant change of thickness.

In thoroughly studied transections on the northern slope of the Aldan Shield, along the Lena and Botoma Rivers, the width of this zone for the whole excavated here Cambrian section is about 200 km. In the north-western direction it tapers to 150 km what is proved out by data on deep boring; in the south-east towards the central regions of the Aldan Shield the zone has tendency to widening.

A distinctive feature of the region in question is a significant variability of facies and faunal assemblages at short distances. Widely distributed are algae and archaeocyaths forming buildups of different morphology and size which are accompanied by oolitic and clastic carbonate rocks. Other groups of fossils are abundant and diverse. Among trilobites predominant are local genera and species with elements of fauna of the Pacific palaeobiogeographic region.

The main regularities of geological structure of the transitional zone itself can be traced on the geological profile along the Lena River compiled on the material

collected by a group organized by V.E.Savitsky.

The existence of a wide shallow zone have already been recorded within the Anabar-Sinsk Facies Region at the very beginning of the Tommotian age. This zone was a facies barrier between salt-productive and open marine basins. Algal and archaeocyathan-algal bioherms, both scattered and grouping in separate biohermal beds and massives, occur in the lower part of the Pestrotsvet Formation in the Oymuran village area and can be traced in the western direction up to the Malykan village. They did not much influence on the composition of deposits containing them. Westwards, limestones of the Pestrotsvet Formation submerge beneath the water level and a zone of their replacement with dolostones of the Yuedey Formation is not accessible for studying in natural outcrops.

The upper half of the Pestrotsvet Formation in the Oymuran village area comprises a large biohermal buildup (the Kokoulin or Oymuran Biohermal Massif of Zhuravleva, 1972 a.o.; Astashkin, 1979). However, the Pestrotsvet Formation preserved the main peculiarities of its composition even wesrwards from it (first kilometres). In the Zhurinsky Mys area a thick and complex massif is localized at this level (the Negyurcheñe Taphostromal Massif of Zhuravleva, 1972 or Biostromal Massif of Varlamov and Sundukov, 1979). It is built by algal and archaeocyathan-algal bioherms. Westwards, rocks, typical of the Pestrotsvet Formation are not recognized in the section. Deposits formed during the same interval of time are represented here by the Nokhoroy Member. The upper part of the Nokhoroy Member occupies the back position regarding the organogenous massif. It is characterized by development of grey-coloured, so called "wavy bedded" limestones, dolostones, argillaceous dolostones. In its lower part, except the enumerated rocks, widely distributed are also algal biohermal constructions without distinct morphology. In places, they contain archaeocyathan-algal bioherms as well. Westwards, the sediments of the Nokhoroy Member are traced somewhat farther to the Malykan village and then submerge beneath the water level. Its thickness averages 35-40 m.

It should be noted that beginning from the level of the

Nokhoroy Member it is almost impossible to trace any marker horizons from the western sections of the transitional zone to the eastern ones.

The next, Churan Member consists of clastic-oolitic carbonates which are of predominantly dolomitic, more seldom calcareous composition. It is characterized by well developed structures of cross bedding and abundant pebbles of oolitic rocks. In the vast territory from the Malykan village to the Achchagyy-Yurekh River its thickness maintains 17-20 m. To the west from the village inequigranular clastic rocks are prevailed and their thickness gradually increases to 50 m and in the Elovka village area the Churan Member is completely replaced with dolostones of the Yuedey Formation. In the eastern direction from the Achchagyy-Yurekh River the thickness of clastic-oolitic beds sharply increases to 60 m (the Zhurinsky Mys). In the same area it passes to a higher hypsometrical level and overlies the arch of the mentioned above Negyurchene Massif which limits a distribution of deposits of the upper part of the Pestrotsvet Formation section to the west. Approaching the Kisi-Taas River area the Churan Member is gradually replaced by the Oymuran Massif upper part which is much bigger than its lower part. This buildup at the observed level is represented by organogenous (algal and archaeocyathan-algal) and heterogenous clastic carbonates, mainly dolomitic, of psammitic and psephitic size, including, in places, lenses of brachiopod shells with traces of mechanical distortion. Resulting from processes of dolomitization and some other diagenetic changes, the main part of rocks here transferred to crystalline-grained porous dolomites which in many cases preserved their primary structural peculiarities. In places, mainly in a biohermal facies, the rocks also preserved a primary calcareous composition.

It is necessary to note that among scientists there are different view-points on tracing the Churan Member along the Lena River outcrops. The first view-point is similar to the mentioned above (Arkhangel'skaya et al., 1960). Other view-points are such as: the Churan Member can be regarded as a marker horizon only between the Malykan-Krestyakh villages

(Khomentovsky, Repina, 1965) or: the Churan Member is traced at a great distance (up the Achchagyy-Yurekh River) and farther, to the east, but in the Zhurinsky Mys area oolitic dolostones occupy a higher stratigraphic position(Zhuravleva, Meshkova, Luchinina, 1969).

Between the Isit' and Zhurinsky Mys, above the Churan Member, there is a thick and complex unit which is named Mukhatta Formation by Savitsky (Rozanov, Sokolov, 1984). It consists of crystalline-grained, clastic dolostones which preserved cross-bedded, massive, porous-cavernous, bioherm-like structure. In places, it comprises limestone interbeds. Insufficient investigation of the inner structure of this formation does not enable us to subdivide it into facies.

In eastern sections, in Malykan village, the Tolba River mouth area, at this level there are the El'gyan and Tolbachan Formations. They are separated from the underlying Churan Member and Yuedey Formation by a thin but contineous horizon of algal limestones, calcareous sandstones and dolostones (beds КЛ-МН of Khomentovsky, Repina, 1965 or Marbaday Member of Varlamov, Sundukov, 1979). It is traced to the east, up to the Isit' section, and a bit farther, disappearing then at the base of the Mukhatta Formation.

In the eastern direction the Mukhatta Formation as well as the Churan Member, underlying it, passes into the organogenous-clastic Oymuran Massif which builds the upper part of the section on the Lena River left and right banks in the Oymuran village area.

While approaching this buildup from the east the Perekhod (Transitional) Formation is distinguished in the Lower Cambrian section above the Pestrotsvet Formation. On the whole, it is a wedge-shaped body sharply reducing its thickness towards the east (about 25 m near Chastyr' village) and increasing it to 75 m and more in the western direction (Khomentovsky, Repina, 1965). It is characterized by sharp dissimilarity of different parts of the sequence. Its First Member with all its peculiarities resembles the Pestrotsvet Formation. Second and Third members in marginal eastern sections are mainly represented by bedded, often argillaceous limestones and marlstones. They resemble the Pestrotsvet

Formation by a feature of interbedding and differ from it only by weak development of red rocks. But when approaching the Ulakhan-Taryng-Oymuran area, in their western sections, both members merge into a single body consisting of algal biostroms and bioherms. The Fourth Member, crowning the section of the Perekhod Formation, is represented by dark-coloured, parallel-bedded limestones which, by their composition and structural peculiarities, are similar to those of the Sinsk Formation. In the western direction it is completely replaced by dolostones, as well as the Second and Third members underlying it (Khomentovsky, Repina, 1965; Khomentovsky et al., 1972). In the composition of these dolostones organogenous-clastic varieties predominate, what makes it possible to include the Forth Member in the Oymuran Massif assemblage (Varlamov, Sundukov, 1979; Astashkin, 1979).

At upper, in comparison with the described ones, levels the eastern boundary of the Oymuran Massif, in the Lena River section, becomes vague as, downstream, the banks are outcropped at a lesser height. Here, beginning from the outcrop near the Ulakhan-Kyyry-Taas River, the Perekhod Formation is overlain by the Sinsk one. The Sinsk Formation comprises dark-grey, mostly black, thin-parallel bedded limestones, with a varying amount of argillaceous content, and includes horizons of pyroschists and slumps. The thickness of the Sinsk Formation, as well as Perekhod one, increases east to west from 40 to 75-80 m. It should be noted that in a parallel section along the Botoma River, the Oymuran Massif and the Sinsk Formation are at the same hypsometric level and divided by a gap about 1,5 km wide.

Thus, large, rather narrowly localized, buildups appear within the limits of the Transitional Zone. These buildups are closer to the eastern part of the Transitional Zone and began to play a major part in the formation of the Transitional Zone profile during an accumulation of the upper Pestrotsvet Formation in contradistinction to its earlier stage. Unfortunately, for stratigraphic correlation this part of a Lower Cambrian section of the Lena River is especially unfavourable. Any contineous marker horizons are absent

here because of a sharp variability of facies and thickness of deposits.

Basing upon mentioned above peculiarities of the section, it is possible to define some regularities of facies development within the limits of the Transitional Zone. It follows that the Nokhoroy - Churan Members and the Mukhatta Formation can be defined as a group of facies accumulated within a back reef environment. Organogenous and organogenous-clastic buildups limiting them from the east could be a group of reef facies. It is worth noting that at this level, a lateral transition of facies was accompanied by significant changes in thickness what finally led to a formation of a positive consedimental structure. As a result, a sharp undulation of thicknesses of the Perekhod and Sinsk Formations and also the Nokhoroy and Churan members takes place.

A stratigraphically upper parts of the Lena River Lower Cambrian section is represented by the Kutorgina, Keteme, Titary and Elanskoe (the lower half) formations. Their facies peculiarities are not yet properly studied. As in the eastern direction they are replaced by thin domanik sediments similar to those of the Sinsk Formation which are a part of the Inikan Formation. They can be regarded as a different in lithological sense part of the section of a barrier reef assemblage which occur either in front position towards it (the Kutorgina Formation) or belong to a back reef (the Keteme, Titary Formations) or to a reef assemblage (the Elanskoe Formation).

Inspite of different versions of a correlation for the Atdabanian western and eastern sections, it is indubitable that the zone of maximum development of organogenous buildups is frontal as regards utmost shallow oolitic sediments. For the Botomian stage, if we examine a level of the Sinsk Formation, a zone of development of reef buildups can be surely distinguished as well, limiting an area of the Sinsk Formation from the west.

Cambrian section of the Aldan River has a certain traits of resemblance to the description given above. Here the Pestrotsvet Formation overlies with disconformity the dolostones of the Yudoma Formation characterized

by wide development of oolitic, clastic and algal varieties. In one of the best sections, in the Ulakhan-Sulugur, facies similar to those of the Pestrotsvet Formation appear in the upper part of the Yudoma Formation. Due to some reasons they can be regarded as synchronous to containing them rocks of the Yudoma Formation. Although, there is an opinion concerning their connection with processes of palaeokarst development which preceded the Pestrotsvet Formation sedimentation.

In its western sections the Pestrotsvet Formation comprises dolostones; in the eastern direction, like on the Lena River, limestones predominate. The upper part of the section is represented by the Tumuldur Formation which contains oolitic, clastic, wavy-laminated dolostones. It occupies the same position in the section as the formations attributed to a back reef facies on the Lena River.

The upper part of the Lower Cambrian is represented by the Yungele Formation on the Aldan River. It resembles the Tolbachan one. Open marine facies of domanik type (the upper half of the Lower Cambrian-Amgan Stage of the Middle Cambrian) are exposed downstream the Aldan River, even within the limits of the Yudoma-Olenek Facies Region.

DESCRIPTION OF SECTIONS

The Aldan River sections

"Dvortsy" (Section 1)

The section is on the left bank of the Aldan River, 4 km above the Dyalkhakh Creek mouth. The section was choosen as the Tommotian Stage stratotype (Rozanov, Missarzhevsky, 1966). The Yudoma, Pestrotsvet and Tumuldur Formations are outcroped from the water level (Fig.3).

Yudoma Formation

In this area the Yudoma Formation lies on the crystalline basement. In the very outcrop lower 5-10 m of the formation are not exposed.

thickness(m)

V_{nem} 1. Light-grey, beige, straw-coloured, blueish-grey, yellowish, medium-parting and blocky dolostones.

Interbeds of authigene braccias frequently occur. 4-5 m above the water level there is an interbed of cross-laminated oolitic dolostones, with terrigenous admixture, 17-20 m above - an interbed of grey-blueish, greenish, argillaceous, thin parting to shaly dolostones 36

The following microphytolites are defined in these interbeds - Nubecularites abustus Z. Zhur., Vesicularites porrectus Z. Zhur.

2. White to straw-coloured, sucrosic, medium-parting and blocky dolostones, frequently with mud-flow structures. Interbeds of argillaceous, shaly dolostones and brecciated dolostones occur 42

3. White, light-grey, beige, seldom green, sucrosic, massive-bedded, medium parting and blocky dolostones 42

Approximately in the middle of the bed the trace fossils occur - Planolites sp., Cochlichnus sp.

4. Dolostones similar to those of bed 3 5

At the bottom (at the level 120 m above the water level) and top (at the level of about 125 m above the water level) of the bed the stromatolites occur - Jurusania tumuldurica Kryl.

5. The lower part of the bed (about 5-6 m) is represented by mottled and banded, light-brown, blueish-grey and beige, obscurely bedded and blocky dolostones. The upper part of the bed - by light-grey or light-beige, medium-grained, thick parting dolostones 15

6. Light-grey, white, probably oolitic, coarse-grained, cavernous, blocky dolostones 4.5

7. Light-grey, sucrosic, medium-parting dolostones 2

8. Alternation of thin-parting to foliated, argillaceous and thin banded, medium-parting dolostones. The last interbeds often with terrigeneous admixture. Dolostones of predominantly pale green shades. In the middle part of the bed there is an interbed (0,6 m) of massive dolostones 9

At 3-3,5 m from the base of the bed the problematics occur - Lobiochrea ? sp., Chancelloria ? sp. and cf. Hyolithellus sp. (then, probably, Nevadatubulus).

9. Pinkish-, beigeish- or greenish-grey dolostones with a conchoidal break, sucrosic, thin- or medium - parting 8

10. Dolomitic, light- or pinkish-grey, fine-pebble (pebbles to 3-5 sm in size), massive conglomerates. Fragments are well rolled, cement is dolomitic 0.5

11. Light-coloured, beigeish and greenish, plane parallel laminated, thin parting to shaly dolostones. Separate interbeds enriched by argillaceous material 1

12. Light-grey, oolitic, oblique-bedded, thick-parting dolostones 1.3

13. Light-grey, sucrosic, thin-bedded, medium-parting dolostones 1.6

$\epsilon_1$tom^{sun} 14. Light-grey, oolitic, cross-laminated, cavernous, blocky dolostones. 2 m below the bed top there is an interbed (0.6 m) of light-grey algal limestones 5

0.25-0.5 m below the bed top the hyoliths occur - Turcutheca crassecochlia(Sys.),Conotheca sp.,Spinulitheca billingsi(Sys.),Laratheca nana Miss.,Exilitheca multa Sys.;the molluscs-Barskovia hemisymmetrica Gol., Bemella costata Fedorov, Aldanella rozanovi Miss.; the skeletal problematics (SSF) - Hyolithellus tenuis Miss., H.tschuskunensis Valk., Torellella curva Miss., T.lentiformis (Sys.), Coleolus trigonus (Sys.), Sachites proboscideus Mesh., Halkieria sacciformis (Mesh.), Chancelloria marrocana Sdzuy, Allonnia tripodophora Doré et Reid, Stellaria lenaica (Zhur. et Korde), S.aldanica (Zhur. et Korde) and non-defined fragments of archaeocyaths.

Throughout the whole bed there are the microphytolites - Nubecularites abustus Z.Zhur. and the calcareous algae of poor preservation - Korilophyton ? sp., Renalcis gelatinosus Korde, Girvanella sp.

Pestrotsvet Formation

The Pestrotsvet Formation lies on wavy eroded surface of the Yudoma Formation.

15. Light-grey, pinkish or greenish, flaggy limestones with admixture of clastic material and glauconite, especially at the base of the bed. Some interbeds, in the upper part of the bed in particular, are enriched by argillaceous material. In the lower part of the bed abundant fossils occur, forming interbeds of shell hash 4.2

Throughout the bed there are the archaeocyaths - Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus sp., Nochoroicyathus sunnaginicus (Zhur.), N.virgatus (Zhur.), N.tkatschenkoi (Vol.), N.belvederi (Roz.), N.fabrefactus Vor., N.aldanicus Zhur., N.vulgaris Zhur., Cambrocyathellus tschuranicus Zhur., Okulitchicyathus discoformis (Zhur.); the hyoliths (especially abundant in the lower 1-2 m like the following fauna) Ladatheca annae (Sys.), Turcutheca crassecochlia (Sys.), Allatheca concinna Miss., Exilitheca multa Sys., Laratheca nana Miss., Conotheca mamilata Miss., Korilithes sp., Jacutolituus fusiformis Miss., Spinulitheca billingsi (Sys.), S. ? kuteinikovi (Miss.), Loculitheca rugata (Sys.), Curtitheca korobovi (Miss.); the molluscs - Bemella parula Miss., B.jakutica (Miss.), B.septata (Miss.), B.costata Fedorov, Aldanella rozanovi Miss., A.attleborensis (Sh.et F.), A.utchurica Miss., Barskovia hemisymmetrica Gol., Igorella monstrosa Miss., Isitiella impocera Miss., Nomgoliella rotunda H.Zhegallo, Yochelcionella sp., Obtusoconus chonorabilis Yü, Watsonella sibirica (Miss.); the brachiopods - Aldanotreta sunnaginensis Pelm.; the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., H.grandis Miss., Torellella lentiformis (Sys.), T.curva Miss., Tommotitubulus savitzkyi Fedorov, Coleoloides trigeminatus Miss., Coleolus trigonus Sys., Tommotia plana (Miss.), T.admiranda (Miss.), Halkieria sacciformis (Mesh.), H.meshkovae (Fedorov), Chancelloria simmetrica Vass., Stellaria lenaica (Zhur. et Korde), S.aldanica (Zhur.et Korde), Archiasterella tetractina Vass.et Sayutina, Markuelia secunda Val., Tumulduria incomperta Miss., Sunnaginia imbicata Miss., Sulugurella sulugurica Fedorov, Polycladium sp., Hyalostellia sp., Asteroctinella sp., Protospongidae gen.indet, Yakutiochrea cf.tristicha (Miss.).

In the upper part of the bed the following skeletal problematics are recorded - Anabarites sp., Tiksitheca licis Miss., Tommotia kozlowskii (Miss.), T.admiranda (Miss.), T.plana (Miss.), Camenella garbowskae Miss., Halkieria sacciformis (Mesh.), Sachites proboscideus Mesh.

$1^{tom^{reg}}$ 16. Strongly argillaceous limestones of intersive red colour. In the lower 2-3 m an abundance of glauconite and shells. Above, there is only a sporadic occurrence of fossils in lighter colour limestones with grey and greenish-grey interbeds

22-25

In the lower part of the bed the archaeocyaths: Dokidocyathus regularis Zhur., Nochoroicyathus virgatus (Zhur.), N. tkatschenkoi (Vol.), N.belvederi (Roz.), N.pseudooccultatus Roz., Erismacoscinus rojkovi (Vol.), Dictyocyathus translucidus Zhur.; the hyoliths - Ladatheca annae (Sys.), Turcutheca crassecochlia (Sys.), Allatheca corrugata Miss., A.concinna Miss., Loculitheca sysoievi (Mesh.), Laratheca tchurani (Sys.), L.nana Miss., Spinulitheca billingsi (Sys.), Ovalitheca rasa Sys., Tchuranitheca simplicis Sys., Notabilitus simplex Sys., Burithes distortus (Sys.), Oblisicornus compositus Sys., O.dupleconcavus Sys., Crestjahitus compressus Sys., Korilithes sp., Jacutolituus fusiformis Miss., Antiquatheca pauca Miss.; the molluscs - Bemella jacutica (Miss.), Igorella monstrosa Miss., Latouchella korobkovi (Vost.), Anabarella indecora Miss., Aldanella rozanovi Miss., Watsonella sibirica (Miss.); the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., H.grandis Miss., Torellella lentiformis (Sys.), Anabarites ? sp., Cambrotubulus decurvatus Miss., Tiksitheca korobovi (Miss.), Tommotia kozlowskii (Miss.), T.admiranda (Miss.), Camenella garbovskae Miss., Lapworthella cf. tortuosa Miss., Halkieria sacciformis (Mesh.), Sachites proboscideus Mesh., Fomitchella sp., Chancelloria sp.

In the middle and upper parts of the bed the archaeocyaths are recorded - Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus regularis Zhur., Nochoroicyathus sunnaginicus (Zhur.), N.tkatschenkoi (Vol.), N.ex gr. anabarensis (Vol.), N.aldanicus Zhur., Erismacoscinus rojkovi (Vol.), Dictyocyathus translucidus Zhur., Cambrocyathellus tschuranicus Zhur., Okulitchicyathus discoformis (Zhur.); the hyoliths - Exilitheca multa Sys., Eonovitatus superbus Sys., Notabilitus simplex Sys., N.orientalis Sys., Obliquatheca bicostata (Miss.), Dorsojugatus sedecostatus (Sys.), Crestjahitus compressus Sys. Other fossils of the lower half of the bed occur sporadically in this part.

17. Strongly argillaceous, red limestones, with frequent interbeds of grey and greenish-grey limestones. Throughout the whole bed there are abundant, large (in average about 1 m) bioherms with archaeocyaths 21

In the lower part of the bed the archaeocyaths occur-

Cryptoporocyathus junicanensis Zhur., Nochoroicyathus tkatschenkoi (Vol.), N.transitorius (Vor.), N.mutabilis (Vor.), N.pallidus (Vor.), Cambrocyathellus tschuranicus Zhur., Dictyocyathus translucidus Zhur., Okulitchicyathus discoformis (Zhur.); the hyoliths - Laratheca nana Miss., Notabilitus orientalis Sys., Conotheca mammilata Miss., Obliquatheca aldanica (Sys.), O.bicostata (Miss.); the SSF - Hyolithellus sp., Torellella sp., Tommotia kozlowskii (Miss.), Camenella garbowskae Miss.; the algae - Renalcis jacuticus Korde, R.cibus Korde, R.polymorphus Korde, Proaulopora glabra Krasnop., Subtifloria delicata Masl., Girvanella sibirica Masl., Kordephyton crinitum (Korde), Epiphyton sp.

$\epsilon_1$tom^{len} In the upper part of the bed (45 m above the top of the Yudoma Formation) the archaeocyaths are recorded - Nochoroicyathus tkatschenkoi (Vol.), N.mutabilis (Vor.), N.anabarensis (Vol.), N.transitorius (Vor.), Orbicyathus sp., Tumulocyathus sp., Dictyocyathus sp.; the hyoliths - Notabilitus orientalis Sys., Obliquatheca bicostata (Miss.), Ovalitheca rasa Sys., Oblisicornus compositus Sys., Eonovitatus superbus Sys., Dorsojugatus sedecostatus (Sys.), Conotheca mammilata Miss.; the SSF - Rushtonia sp., Halkieria sp., Chancelloria sp.

18. Argillaceous, greyish-pink, grey-violet, flaggy limestones, alternating with interbeds of grey limestones. Number and thickness of the latter increase up the section 35

5 m above the bottom of the bed there are the hyoliths - Majatheca tumefacta Miss., Obliquatheca bicostata (Miss.); at 9-10 m the brachiopods - Cryptotreta neguertchenensis Pelm.; at 10 m - the SSF - Mobergella radiolata Bengt.

Tumuldur Formation

The Pestrotsvet Formation grades into the Tumuldur Formation.

$\epsilon_1$atd 19. Argillaceous, grey, greenish-grey, wavy bedded limestones and dolostones up to 70

Ulakhan-Sulugur (section 2)

The section is along the left bank of the Aldan River, 7 km above the Ulakhan-Sulugur Creek mouth.

The Precambrian-Cambrian boundary stratotype is established in this section as well as the stratotype of the sunnaginicus Zone. Outcrops of the Yudoma, Pestrotsvet and Tumuldur Formation

begin from the water level (Fig. 3).

Yudoma Formation

Thickness (m)

Vnem 1. Yellowish- and greenish-grey, fine-grained, thin-bedded dolostones with lenses of silicified oncolitic limestones. Lenses 0.05 to 0.3m height, to 1.2m wide. up to 1.2

2. Light-grey dolostones, in the lower half - brecciated, oolitic, in the upper half - fine-grained, thin-bedded ones 0.85

3. Oolitic, light-grey dolostones, in the upper part there is an interbed of brecciated dolostones 0.9

4. Light-grey, fine-grained, blocky dolostones, transferring along the line of strike into wavy-bedded, thin parting 0.8

5. Dolomitic, yellowish-grey, authigenous breccias, with uneven thickness along the line of strike 0.3

6. Yellowish-grey, thin-bedded, blocky, strongly cavernous dolostones 0.7

7. Dolomitic, yellowish-grey, authigenous breccias with oolites 0.3

The microphytolites Nubecularites abustus Z.Zhur. are defined from beds 1-7.

$\epsilon_1 tom^{sun}$ 8. Glauconitic-carbonate sandstones with admixture of quartzose material and fossil fragments lie conformably on the underlying bed with traces of a slight washout 0.1

The following fossils are recorded in the bed: the archaeocyaths: Nochoroicyathus cf. virgatus (Zhur.); the hyoliths: Turcutheca crassecochlia (Sys.), Laratheca nana Miss., Exilitheca multa Sys., Conotheca cf. mammilata Miss., Spinulitheca ? kuteinikovi (Miss.), Ladatheca annae (Sys.); the molluscs - Aldanella rozanovi Miss., Barskovia sp., Bemella jacutica Miss., Obtusoconus sp.; the SSF - Hyolithellus tenuis Miss., Torellella curva Miss., T.lentiformis (Sys.), Cambrotubulus decurvatus Miss., Coleoloides trigeminatus Miss., Tiksitheca licis Miss., Sunnaginia imbricata Miss., Halkieria sacciformis (Mesh.), Chancelloria sp., Stellaria aldanica (Zhur. et Korde), Allonnia tripodophora Dore et Reid, Polycladium sp., Spinulitheca sp.; the microphytolites - Nubecularites abustus Z.Zhur.

9. Light-grey, thin-bedded and arenaceous brecciated dolostones 0.7

10. Light-grey, sucrosic, thin-bedded, blocky dolostones,

with interbeds of arenaceous dolostones 0.4

The hyoliths occur - Turcutheca crassecochlia (Sys.); the microphytolites - Nubecularites abustus Z.Zhur.; the SSF-Hyolithellus sp., Chancelloria sp., Markuelia sp.

11. Grey, sucrosic, cross-laminated, blocky dolostones, in the upper part with interbeds of arenaceous and brecciated dolostones 0.3

Pestrotsvet Formation

The Pestrotsvet Formation lies on the Yudoma Formation rocks on uneven surface with deep pockets.

12. Strongly glauconitic, grey limestones, sometimes tinged with greenish or pinkish. At the base of the bed abundant clastic material 3-5

All over the bed small bioherms with the archaeocyaths occur - Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus sp., Nochoroicyathus sunnaginicus (Zhur.), N.virgatus (Zhur.), N.belvederi (Roz.), N. aldanicus Zhur., Cambrocyathellus tschuranicus Zhur., Okulitchicyathus discoformis (Zhur.), and also the hyoliths - Exilitheca multa Sys., Turcutheca crassecochlia (Sys.), Laratheca nana Miss., Allatheca sp., Spinulitheca ? kuteinikovi Miss., S.billingsi (Sys.), Jacutolituus fusiformis Miss., Curtitheca korobovi (Miss.); the molluscs - Aldanella rozanovi Miss., A.attleborensis (Sh. et F.), Bemella jacutica (Miss.), B.parula Miss., B.septata (Miss.), Obtusoconus sp., Barskovia sp., Watsonella sibirica (Miss.), Purella cristata Miss.; the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., H.grandis Miss., H.tschuskunensis Valk., Torellella lentiformis (Sys.), T.curva Miss., Tiksitheca licis Miss., Cambrotubulus decurvatus Miss., Coleoloides trigeminatus Miss., Coleolus trigonus Sys., Tommotia admiranda (Miss.), T.plana (Miss.), Camenella garbowskae Miss., Lapworthella tortuosa Miss., Halkieria sacciformis (Mesh.), Sunnaginia imbricata Miss., Tumulduria incomperta Miss., Fomitchella sp., Polycladium sp., Suluguriella sulugurica Fedorov, Hyalostellia sp., Protospongidae gen.indet, Chancelloria simmetrica Vass., C.marocana Sdzuy, C.spinulosa Vass., Allonnia tripodophora Dore et Reid, Stellaria lenaica (Zhur. et Korde), S.aldanica (Zhur.et Korde), Aldania flabellata Vass., Archiasterella palmiformis Vass., A. tetractina Vass. et

Sayutina Markuelia secunda Val.; the brachiopods - Aldanotrera sunnaginensis Pelm.; the algae - Renalcis jacuticus Korde. Aldanotreta sunnaginensis Pelm.

$\epsilon_1$tom^{reg} 13. Strongly argillaceous, red and dark-red - red, flaggy limestones, in the lower part of the bed with an admixture of glauconite and abundant fossils. Above, sparse, thin interbeds of grey limestones occur 17

In the lower half of the bed the hyoliths are recorded- Spinulitheca sp., Allatheca corrugata Miss., A.concinna Miss., Ladatheca annae(Sys.), Laratheca nana Miss.; the molluscs - Bemella jacutica (Miss.),B.septata(Miss.),Igorella monstrosa Miss.,Latouchella korobkovi(Vost.),Anabarella indecora Miss., Aldanella rozanovi Miss., Watsonella sibirica (Miss.); the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., H. grandis Miss., Torellella lentiformis (Sys.), Anabarites sp., Coleoloides trigeminatus Miss., Tommotia kozlowskii (Miss.), T.plana (Miss.), T.admiranda (Miss.), Camenella garbowskae Miss., Lapworthella cf. tortuosa Miss., Halkieria sacciformis (Mesh.), Chancelloria sp.

10 m above the bottom of the bed the hyoliths occur - Burithes distortus (Sys.), Antiquatheca pauca Miss.

All over the bed the trace fossils - Planolites beverleyensis (Bill.), P.striatus (Hall), Rhizocorallium jenense Zenker, Chondrites sp., Dactyloidites sp.

14. Argillaceous, red, flaggy limestones, with sparse thin interbeds of grey and greenish-grey limestones. All over the bed numerous bioherms with archaeocyaths occur 22

From the lower part of the bioherms the archaeocyaths are defined - Dokidocyathus regularis Zhur., Nochoroicyathus anabarensis (Vol.), N.mirabilis Zhur., Retecoscinus sakhaensis A.Zhur., Erismacoscinus rojkovi (Vol.), Dictyocyathus translucidus Zhur.; the algae - Renalcis cibus Korde, R.jacuticus Korde; R.polymorphus (Masl.), Girvanella sibirica Masl., Kordephyton crinitum (Korde),Epiphyton sp.

In the lower part of the bed the hyoliths - Burithes distortus (Sys.), Obliquatheca bicostata (Miss.), Laratheca nana Miss.

$\epsilon_1$tom^{len} In the upper part of the bed the archaeocyaths-

Dokidocyathus lenaicus Roz., Nochoroicyathus anabarensis (Vol.), N. pseudooccultatus Roz., Orbicyathus sp.

In limestones the sparse hyoliths of poor preservation occur all over the bed - Obliquatheca bicostata (Miss.), Conotheca sp., Majatheca sp.; other SSF - Halkieria sp., Chancelloria sp.

15. Alternation of greyish-pink, light lilac- and greenish-grey limestones, towards the top of the bed a number and thickness of greenish-grey interbeds increase 30

The upper half of the bed contains the hyoliths - Obliquatheca bicostata (Miss.), Burithes cuneatus Miss., Majatheca tumefacta Miss.; the brachiopods - Cryptotreta neguertchenensis Pelm.; the SSF - Hyolithellus sp., Torellella biconvexa Miss., Rushtonia sp., Tommotia kozlowskii (Miss.), Camenella garbowskae Miss., Halkieria sp., Chancelloria sp.

Tumuldur Formation

The Tumuldur Formation lies with a gradational transition on the underlying Pestrotsvet Formation.

16. Argillaceous, grey and greenish-grey, wavy bedded limestones and dolostones more then 100

The bottom of the bed contains the SSF of poor preservation - Hyolithellus sp., Chancelloria sp.

The Lena River sections

Isit' (Section 3)

Section 3 occupies the right bank of the Lena River, opposite the Isit' village (Fig. 4).

A part of the section (beds 3-9) is excavated by a prospect hole.

The section in question is the hypostratotype of Tommotian Stage and the stratotype of the regularis and lenaicus - primigenius Zones.

Tolba Formation

Thickness(m)

$\epsilon_1 tom^{sun}$ 1. Limestones with microphytolites and dolostones of grey colour above in the bed, smth. There are light-grey, micrograined, massive bedded limestones 2-2.5

The algae - Korilophyton inopinatum Vor., Renalcis gelatinosus Korde, Subtiphloria gracila Luch., Botomaella zelenovii Korde; the hyoliths - Circothecidae gen. et sp. indet;

the molluscs - Coreospiridae gen. et sp. indet., the microphytolites - Nubecularites abustus Z.Zhur.

2. Not exposed 9

Pestrotsvet Formation

3. Dolomitic, grey, flaggy limestones 0.4

4. Mottled, greyish-yellow limestones, with greenish feebly dolomitic interbeds, in the lower part with glauconite 0.35

The following SSF are found - Hyolithellus vladimirovae Miss., Coleoloides trigeminatus Miss., Chancelloria sp.

5. Limestones and dolomitic limestones, grey and greenish-grey, sometimes with brown spots. On the bedding surface there are sometimes thin stringes of glauconite 0.35

6. Grey, nodular, lenticular limestones 0.23

7. Feebly argillaceous, greenish-grey, flaggy limestones, enriched by glauconite in separate interbeds 0.9

The hyoliths occur - Spinulitheca billingsi (Sys.), Ladatheca annae (Sys.), Turcutheca crassecochlia (Sys.), Laratheca nana Miss., Conotheca sp., Allatheca corrugata Miss., Exilitheca multa Sys.; the molluscs - Aldanella rozanovi Miss.; the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., Torellella sp., Tommotia kozlowskii(Miss.), T.admiranda(Miss.), Tiksitheca licis Miss., Coleoloides trigeminatus Miss., Halkieria sacciformis (Mesh.),Chancelloria sp.

8. Greenish-grey to reddish limestones, in the middle part of the bed with admixture of terrigenous material 0.1

9. Argillaceous, ruddy-red, often nodular, lenticular or wavy bedded limestones 1.1-1.2

ϵ_1 tom^{reg} 10. Strongly argillaceous, dark-red-red limestones,with a significant admixture of glauconite, medium- and thin-parting. Bioherms (1-1.5 m high) with archaeocyaths are found. Limestones are overfilled with abundant fossils, they are a good markers - Khatyng Member (Rozanov et al., 1969) 4-5

The archaeocyaths are defined - Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Nochoroicyathus virgatus (Zhur.), N.sunnaginicus (Zhur.), N.tkatschenkoi (Vol.), N.belvederi (Roz.), N.similis(Vol.),N.supervacuus

Roz., N.anabarensis (Vol.), N.vulgaris Zhur., N.aldanicus Zhur., Retecoscinus sakhaensis A.Zhur., Dictyocyathus translucidus Zhur.; the corallimorphs - Cysticyathus tunicatus Zhur.; the hyoliths - Spinulitheca billingsi (Sys.), Turcutheca crassecochlia (Sys.), Laratheca tchurani (Sys.), L.nana Miss., Burithes distortus (Sys.), Tchuranitheca simplicis Sys., Crestjahitus compressus Sys., Allatheca corrugata Miss., Exilitheca ancestralis Sys., E.multa Sys., Ladatheca annae (Sys.), Notabilitus simplex Sys., Oblisicornus tetraconcavus Sys., Antiquatheca pauca Miss., Jacutolituus fusiformis Miss., Korilithes sp.; the molluscs - Bemella jacutica (Miss.), Igorella monstrosa Miss., Ilsanella sp., Isitiella inpocera Miss., Latouchella korobkovi (Vost.), Anabarella indecora Miss., Aldanella rozanovi Miss., Watsonella sibirica(Miss.); the SSF - Hyolithellus tenuis Miss., H.vladimirovae Miss., H. grandis Miss., H.insolitus Grig., Torellella lentiformis(Sys.), Anabarites sp., Coleoloides trigeminatus Miss., Tommotia kozlowskii (Miss.), T.plana (Miss.), T.admiranda (Miss.), Camenella garbowskae Miss., Lapwortella tortuosa Miss., Halkieria sacciformis (Mesh.), Sunnaginia imbricata Miss.,Chancelloria sp., Allonnia sp., Archiasterella tetractina Vass. et Sayutina.

At the base of the bed - Tiksitheca korobovi (Miss.).

In the bioherms: the algae - Renalcis jacuticus Korde.

11. Argillaceous, ruddy-red limestones with admixture of terrigenous material and sparce grains of glauconite. At the bottom of the bed a thin interbed of greenish limestones. Several interbeds of cross bedded limestones. All over the bed there are traces of activity of mud-eaters and an assemblage of fossils known from the preceeding bed. A number of the latter decreases from top to bottom. In the upper part of the bed sparse bioherms with archaeocyaths exist 11

In the bioherms the following archaeocyaths are defined- Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus regularis Zhur., Nochoroicyathus tkatschenkoi (Vol.), N.anabarensis (Vol.), N.mirabilis Zhur., N. aldanicus Zhur., Erismacoscinus rojkovi (Vol.). In the bed the problematics are recorded - Aldanolina magna Pelm.; the SSF - Chancelloria sp.; the algae - Renalcis jacuticus Korde, R. gelatinosus Korde, Epiphyton scapulum Korde. At the base of

the bed the hyoliths - Loculitheca sysoievi (Mesh.), Turcutheca crassecochlia (Sys.), Laratheca tchurani (Sys.), L. nana Miss., Ladatheca annae (Sys.), Burithes distortus (Sys.), Crestjahitus compressus Sys., Oblisicornus compositus Sys.

In the middle part of the bed the hyoliths - Tchuranitheca simplicis Sys., Allatheca corrugata Miss., Notabilitus simplex Sys., Oblisicornus tetraconcavus Sys., O. dupleconcavus Sys., Crestjahitus compressus Sys., Jacuticornus tenuistrigatus (Sys.), Isititheca lenae Sys., Dorsojugatus sedecostatus (Sys.), Antiquatheca pauca Miss., Jacutolituus fusiformis Miss.

Other fossils are recorded, the same forms as in bed 10, except the following - Hyolithellus insolitus Grig., Sunnaginia imbricata Miss., Anabarites sp., Tiksitheca korobovi (Miss.), Latouchella korobkovi (Vost.), Anabarella indecora Miss.

$\epsilon_1$tom^{reg} 12. Argillaceous, ruddy-red limestones with interbeds of grey and grey-green limestones 12-13

One of such interbeds (0.2-0.3 m) contains the archaeocyaths at the bottom of the bed - Nochoroicyathus tkatschenkoi (Vol.), N. cf. mirabilis Zhur., Okulitchicyathus discoformis (Zhur.), Dictyocyathus translucidus Zhur., Sakhacyathus ex gr. subartus (Zhur.), Tumuloocyathus kotuyikensis australis (Roz.); the hyoliths - Ladatheca annae (Sys.), Allatheca corrugata Miss., Obliquatheca bicostata (Miss.), Conotheca mammilata Miss., Majatheca tumefacta Miss., Exilitheca multa Sys., Turcutheca crassecochlia (Sys.).

6.5 m above the bottom of the bed some bioherms with archaeocyaths occur.

At the top of the bed the hyoliths: Oblisicornus compositus Sys., Eonovitatus superbus Sys., E. grandis (Mesh.), Dorsojugatus sedecostatus (Sys.), Notabilitus orientalis Sys.

13. Argillaceous, ruddy- and dark-red-red, flaggy limestones, with frequent interbeds (0.4-0.5 m) of grey and grey-green, massive bedded limestones. 4 m above the bottom of the bed bioherms with archaeocyaths occur. The bioherms are 7 m long and up to 5:2 m high. There is an algal biostrom of 0.3-0.5 m in size at the top of the bed 10

1.2-4.5 m above the bottom of the bed archaeocyaths occur - Archaeolynthus polaris (Vol.), Cryptoporocyathus

junicanensis Zhur., Nochoroicyathus tkatschenkoi (Vol.), N. anabarensis (Vol.), N.aldanicus Zhur., N.mirabilis Zhur., Tumulocyathus kotuyikensis (Zhur.), Erismacoscinus rojkovi (Vol.), Dictyocyathus translucidus Zhur., Cambrocyathellus tschuranicus Zhur., Okulitchicyathus discoformis (Zhur.); the hyoliths - Obliquatheca bicostata (Miss.), Microcornus simus Miss.; the molluscs - Aldanella operosa Miss.; fragments of hyolithelmintes.

$\epsilon_1$tom^{len} 4.5-5.6 m above the bottom of the bed the archaeocyaths are recorded - Archaeolynthus polaris (Vol.), Tumuliolynthus primigenius Zhur., Nochoroicyathus tkatschenkoi (Vol.), N.anabarensis (Vol.), N.turbidus (Roz.), N.mutabilis(Vor.), N.pseudoccultatus Roz., N.mirabilis Zhur., N.aldanicus Zhur., N.ridiculus Roz., Tumulocyathus kotuyikensis(Zhur.), Erismacoscinus rojkovi (Vol.), Dictyocyathus translucidus Zhur., Cambrocyathellus tschuranicus Zhur., Okulitchicyathus discoformis (Zhur.).

And 5.6 m above the bottom of the bed the archaeocyaths are also defined - Korshunovicyathus melnikovi (Korsh. et Zhur.), Dokidocyathus ex gr. lenaicus Roz., Nochoroicyathus grandis Zhur., N.supervacuus Roz., Retecoscinus sakhaensis A.Zhur.

5.6-6.8.m above the bottom of the bed the hyoliths - Conotheca mammilata Miss., Obliquatheca bioostata Miss.; the molluscs - Aldanella operosa Miss., Ilsanella sp.; the brachiopods - Cryptotreta neguertchenesis Pelm.; the SSF - Hyolithellus tenuis Miss., H.isiticus Miss., Torellella biconvexa Miss., Torellelloides giganteum Mesh., Anabarites isiticus Miss., Tommotia kozlowskii (Miss.), T.plana (Miss.), Camenella garbowskae Miss., Lapworthella bella Miss., Chancelloria sp.; the algae - Renalcis pectunculus Korde, Epiphyton durum Korde, Girvanella problematica Nich. et Ether.

All over the bed the algae - Renalcis gelatinosus Korde, Epiphyton scapulum Korde, Girvanella problematica Nich. et Ether. and the trace fossils - Rhizocorallium jenense Zenker, Chondrites sp.

14. Alternation of red, pink, lilac, greenish-grey, flaggy and massive, bedded limestones with a varying amount of argillaceous content. There are traces of activity of mudeaters there 17-19

7 m above the bottom of the bed the hyoliths -

Isitheca lenae Sys., Uniformitheca jasmiri (Sys.), Ovalitheca rasa Sys. From the upper half of the bed the hyoliths - Burithes cuneatus Miss., B.distortus (Sys.), Obliquatheca bicostata Miss., Isititheca lenae Sys., Majatheca tumefacta Miss., Conotheca mammilata Miss., Uniformitheca jasmiri(Sys.), Notabilitus simplex Sys., Doliutus sp.; the molluscs - Aldanella operosa Miss.; the brachiopods - Cryptotreta neguertchenensis Pelm., Nochoroiella isitica Pelm.; the SSF - Torellella biconvexa Miss., Rushtonia sp., Tommotia kozlowskii (Miss.), Camenella garbowskae Miss., Rhombocorniculum insolutum Miss., Chancelloria sp.

4 m above the top of the bed the hyoliths - Dorsojugatus sp.

All over the bed the trace fossils occur - Rhizocorallium jenense Zenkor, Chondrites sp.

15. Pink, lilac, dark-red - red, greenish-grey, often mottled, massive-bedded and flaggy limestones with a varying amount of argillaceous content 15-16

$\epsilon_1$atd^{zeg} 7 m above the bottom of the bed there are the hyoliths - Obliquatheca bicostata (Miss.), Burithes cuneatus Miss., B.erum Miss., Majatheca tumefacta Miss., Conotheca mammilata Miss., Ovalitheca rasa Sys., Dorsojugatus sp.; the brachiopods - Cryptotreta neguertchenensis Pelm.; the SSF - Tommotia kozlowskii (Miss.), Camenella garbowskae Miss., Rhombocorniculum insolutum Miss., Chancelloria sp.; the trace fossils - Plagiogmus sp.

16. Grey, on the weathered surface yellow limestones with interbeds of limestones flaggy, lilac and pink, dolomitic, bioturbated. In the upper part of the marker bed (the thickness about 1 m), algal grey limestones occurs - the Isit' Biostrom (Zhuravleva, Meshkova, Luchinina, 1969).

In the interval 5-9 m from the bottom of the bed defined are the following archaeocyaths from pinkish limestones - Nochoroicyathus arteintervallum (Vol.).

In the marker bed - Nochoroicyathus arteintervallum(Vol.), N.sublenaicus Korsh. et Roz., Korshunovicyathus melnikovi (Korsh. et Zhur.), Rotundocyathus ignotus (Korsh. et Roz.), Retecoscinus zegebarti Korsh., Sakhacyathus subartus (Zhur.);

the algae - Renalcis gelatinosus Korde, R.pectunculus Korde, Girvanella problematica Nich. et Ether.

All over the bed the brachiopods - Cryptotreta neguert-chenensis Pelm.

In the middle part of the bed the hyoliths - Obliquatheca aldanica (Sys.), Oxytus sagittalis Sys., Dorsojuggtus multicostatus Sys., Eonovitatus obruptus (Mesh.), Lenatheca dolosa Sys.; the algae - Proaulopora glabra Krasnop., Girvanella problematica Nich. et Ether.

At the top of the bed the hyoliths - Lenatheca groenlandica (Poul.); the brachiopods - Cryptotreta neguertchenensis Pelm.

$\epsilon_1$atd^{jud} 17. Light-grey, thin-medium parting, wavy bedded, bioturbated limestones and dolostones - Nokhoroy Member 23

At the marks 8.5; 14; 16 m and at the top of the bed the trilobites - Profallotaspis jakutensis Rep.

15 m above the bottom of the bed the bioherms with archaeocyaths - Archaeolynthus sp., "Cryptoporocyathus" sp., Nochoroicyathus arteintervallum (Vol.), Tumulocyathus sp., Retecoscinus zegebarti Korsh.

20 m above the bottom of the bed the archaeocyaths - Dokidocyathus sp., Nochoroicyathus arteintervallum (Vol.), N. mirabilis Zhur., Tumulocyathus sp., Retecoscinus zegebarti Korsh.

The same bioherms occur 1.5 km upstream the Lena River at the top of the bed.

8 and 16 m above the bottom of the bed the brachiopods are recorded - Cryptotreta neguertchenensis Pelm.; 14 m - Nochoroiella isitica Pelm.

13 and 20 m above the bottom of the bed the hyoliths - Eonovitatus superbus Sys., Dorsojugatus multicostatus Sys., Uniformitheca jasmiri (Sys.), Conotheca mammilata Miss., Obliquatheca aldanica (Sys.), O.acostae Sys.

20 m above the bottom of the bed the SSF - Camenella garbowskae Miss.

All over the bed the algae - Proaulopora glabra Krasnop., Subtifloria delicata Masl.

18. Argillaceous dolostones and dolomitic limestones, lemon-yellow coloured, with a conchoidal break, flaggy 22

At the bottom and 2 m above the bottom of the bed the trilobites are found - Profallotaspis jakutensis Rep.

$\epsilon_1$atd^{fal} 5 m above the bottom of the bed - Fallotaspis ? sp.

19. Oolitic limestones and light-grey, massive-bedded dolostones - Churan Member 20-22

20. Algal-detrital limestones and white and light-grey, massive-bedded calcareous sandstones with parallel and wavy bedded structures - marker bed К-Л (Khomentovsky, Repina, 1965). The algae - Subtiploria delicata Masl. 2-3

21. Argillaceous; flaggy dolostones and dolomitic limestones, thin plane parallel laminated-bedded - marker bed М-Н (Khomentovsky, Repina, 1965) 10-12

Beds 20 and 21 form the Marbaday Member (Varlamov, Sundukov, 1979).

22. Yellowish-grey, crystal-grained, massive-bedded dolostones with interbeds of argillaceous, thin parting dolostones about 60

Zhurinsky Mys (Section 4)

Section 4 is opposite the mouth of the Negyurchyune Creek, a left tributary of the Lena River. The section is the stratotype of Tommotian - Atdabanian stages boundary and the stratotype of zegebarti, jakutensis, Fallotaspis and anabarus Zones.

The Pestrotsvet Formation and Nokhoroy Member are exposed in the section (Fig. 5).

Pestrotsvet Formation

thickness(m)

$\epsilon_1$tom^{reg} 1. Just at the water level, strongly argillaceous, dark-red-red, flaggy limestones, with abundant small (up to 0.5 m in diameter) archaeocyathan-algal bioherms are exposed 8-9

In the bioherms the archaeocyaths are found - Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus regularis Zhur., Nochoroicyathus tkatschenkoi (Vol.), N. aldanicus Zhur., N. mirabilis Zhur., N. vulgaris Zhur., Erismacoscinus rojkovi (Vol.), Cambrocyathellus tschuranicus Zhur., C. proximus (Fonin), Dictyocyathus translucidus Zhur., Okulitchi-

cyathus discoformis (Zhur.); the corallimorphs - Cysticyathus tunicatus Zhur. are defined and also the algae - Renalcis jacuticus Korde.

In the lower part of the bed, except archaeocyaths, the hyoliths occur - Turcutheca crassecochlia (Sys.), Ladatheca annae (Sys.), Exilitheca multa Sys., E.ancestralis Sys., E. oblonga Sys., Allatheca corrugata Miss., Uniformitheca rhombiformis (Sys.), Oblisicornus compositus Sys., Crestjahitus compressus (Sys.), Notabilitus costatus Sys., N.orientalis Sys., Burithes distortus (Sys.), Jacuticornus tenuistrigatus Sys.; the molluscs - Watsonella sibirica (Miss.); the SSF - Hyolithellus tenuis Miss., Torellella lentiformis (Sys.), Tommotia kozlowskii (Miss.), T.plana (Miss.), T.admiranda (Miss.), Camenella garbowskae Miss., Lapworthella tortuosa Miss., Jakutiochrea tristicha (Miss.), Halkieria sp., Chancelloria sp.

$\epsilon_1 tom^{reg\ 2}$ 2. Strongly argillaceous, dark-red-red, flaggy limestones with sparse, thin (5-10 sm) interbeds of argillaceous, grey-green, light-pink and yellow limestones. Their number and thickness increases upwards the section 22

At the bottom of the bed there is an interbed of ruddy-red, argillaceous limestones with the archaeocyaths - Archaeolynthus polaris (Vol.) Nochoroicyathus anabarensis (Vol.), N.mirabilis Zhur., Retecoscinus sakhaensis A.Zhur., Dictyocyathus translucidus Zhur., Okulitchicyathus discoformis (Zhur.); the hyoliths - Obliquatheca bicostata (Miss.), Burithes sp., Tchuranitheca sinuata Sys., Crestjahitus compressus Sys.; the SSF - Hyolithellus tenuis Miss., Lapworthella bella Miss.

All over the bed the brachiopods - Cryptotreta neguertchenensis Pelm.; the SSF - Tommotia kozlowskii (Miss.), Camenella garbowskae Miss.; the algae - Proaulopora glabra Krasnop.

$\epsilon_1 tom^{len}$ 14 m above the bottom of the bed the brachiopods are found - Nochoroiella isitica Pelm.; the hyoliths - Oblisicornus dupleconcavus Sys.

In the neighbouring section situated in the Negyurchyune Creek mouth, a left tributary of the Lena River, Mobergella radiolata Bengt. is found at this level, in ruddy-red, argillaceous limestones. When correlating with section Zhurinsky Mys, M.radiolata Bengt. occurs 26 m above the bottom of bed 4 of

section 4. By the occurrence of M. radiolata Bengt., 10 m above the bottom of bed 2, a boundary between the regularis and lenaicus - primigenius Zones should probably be drawn.

3. Alternation of argillaceous, red, flaggy limestones with sparse interbeds of weakly argillaceous, grey, greenish and pinkish-grey, massive limestones 14

All over the bed the brachiopods are found - Cryptotreta neguertchenensis Pelm.; the hyoliths - Ovalitheca rasa Sys., Burithes erum Miss., Obliquatheca bicostata (Miss.), Uniformitheca jasmiri (Sys.), Oxytus sagittalis Sys., Majatheca tumefacta Miss., Conotheca mammilata Miss., Notabilitus orientalis Sys., Oblisicornus compositus Sys.; the SSF - Hyolithellus vladimirovae Miss., H. grandis Miss., Torellella biconvexa Miss., Tommotia kozlowskii (Miss.), T. plana (Miss.), Camenella garbowskae Miss., Chancelloria sp.

4 m above the bottom of the bed the SSF - Aldanolina magna Pelm. In the interval 3-4 m above the bottom of the bed the SSF are found - Mobergella radiolata Bengt.

$\epsilon_1$atd^{zeg}; atd^{jak} 4. Argillaceous, ruddy-red and mottled, lilac limestones, with interbeds of greenish-grey, algal limestones (the thickness 0.3-0.4 sm) 7.5

2.6 m; 3.9 and 6.5 m above the bottom the trilobites Profallotaspis sp. and crustaceans Isoxys jurensis Ivantsov are defined.

In algal interbeds the archaeocyaths - Tumuliolynthus sp., Fransuasaecyathus subtumulatus Zhur., Korshunovicyathus melnikovi (Korsh. et Zhur.), Rotundocyathus ignotus (Korsh. et Roz.), Nochoroicyathus arteintervallum (Vol.), N. grandis Zhur., N. dissepimentalis Zhur., N. sublenaicus Korsh. et Roz., Geocyathus sp., Taylorcyathus sp., Tumulocyathus sp., Jakutocarinus sp., Retecoscinus zegebarti Korsh. and the algae - Epiphyton scapulum Korde, E. durum Korde, Renalcis gelatinosus Korde, Girvanella problematica Nich. et Ether.

5. Grey, straw-coloured, beige, wavy bedded limestones. 1 m above the top of the bed - an interbed (0.05 m) of grey, algal limestones 4

At the bottom and 1.5 m above the bottom of the bed there are trilobites - Profallotaspis sp.; at the mark point 2.5

and the top of the bed - Profallotaspis jakutensis Rep.
In the medium part the brachiopods - Cryptotreta neguertchenensis Pelm.

6. Alternation of argillaceous, mottled and ruddy-red limestones and grey, porcelaneous, massive limestones. At the top of the bed there is an interbed of grey limestones with fragments of algae 6

At marks 1 and 1.5 m above the base of the bed the trilobites occur - Profallotaspis jakutensis Rep.; 3.2 m - Profallotaspis sp. In the lower part of the bed the abundant hyoliths-Obliquatheca bicostata (Miss.), Burithes erum Miss., Conotheca mammilata Miss., Eonovitatus superbus Sys., E.obruptus (Mesh.), Dorsojugatus multicostatus Sys.; the SSF - Hyolithellus sp., Torellella biconvexa Miss., Rushtonia sp., Tommotia kozlowskii (Miss.), Camenella garbowskae Miss., Rhombocorniculum insolutum Miss.

2 m below the top of the bed the brachiopods - Cryptotreta neguertchenensis Pelm.

7. Ashy-pink, lemon-yellow, lilac, argillaceous dolostones, in the lower part of the bed with interbeds of ruddy-red limestones 14

$\epsilon_1$atd^{fal} 3 m below the top of the bed and at the top the trilobites are found - Fallotaspis explicata Rep.; the hyoliths-Novitatus oblongus (Mesh.), Oxytus sagittalis Sys.; the brachiopods - Cryptotreta neguertchenensis Pelm.

3 m below the top of the bed the sparse algae - Proaulopora glabra Krasnop.

Nokhoroy Member

8. Dolomitized, light-grey and yellowish-grey, wavy bedded, lenticular limestones, with algal-archaeocyathan bioherms. Found are interbeds of yellow dolomites 8 0

In the interval from 1 to 25 m above the bottom of the bed the trilobites occur - Fallotaspis sibirica Rep.; the algae - Proaulopora glabra Krasnop., Obruchevella delicata Reitl.

$\epsilon_1$atd^{anb} 31 m above the bottom of the bed the trilobites-Pagetiellus anabarus Laz., Archaeaspis hupei Rep.; the algae - Proaulopora glabra Krasnop., Subtifloria delicata Masl.,

Girvanella problematica Nich. et Ether.

35 and 36 m - the trilobites - Archaeaspis hupei Rep.

41 m - the trilobites - Pagetiellus anabarus Laz., Triangullina parvula Rep., Archaeaspis hupei Rep., Nevadella subgroenlandica (Rep.).

$\epsilon_1 atd^{kok}$ 45-55 m above the bottom there are algal-archaeocyathan bioherms with archaeocyaths - Nochoroicyathus arteintervallum (Vol.), N.grandis Zhur., Compositocyathus sp., Taylorcyathus subtaylori Zhur., Degeletticyathus provisus (Sund.), Baikalocyathus rossicus (Zhur.), Erismacoscinus oymuranensis A.Zhur., Tumulocoscinus atdabanensis Zhur., Dictyocyathus bobrovi Korsh.; with algae - Renalcis gelatinosus Korde, R.pectunculus Korde; with brachiopods - Cryptotreta neguertchenensis Pelm.

71 m - the algae - Renalcis gelatinosus Korde, R.pectunculus Korde, Obruchevella delicata Reitl.

73 and 76 m - the trilobites - Pagetiellus anabarus Laz., Bigotina (Bigotinella) rara Rep.

At the top of the bed the trilobites are found - Pagetiellus anabarus Laz.; the hyoliths - Lenatheca dolosa Sys., L. groenlandica (Poul.); the SSF - Kelanella sp.; the algae - Renalcis gelatinosus Korde, Proaulopora glabra Krasnop., Subtifloria delicata Masl.

$\epsilon_1 atd^{ukt}$ 9. Yellow and yellow-grey dolostones.

Two members are clearly visible.

Member I.

Yellow-grey and greyish-brown-grey, apoolitic, massive dolostones, often with[a] cross-laminated structure and cross-pillar jointing alternating with yellowish-grey, fine-grained dolostones 49

0.5 m above the bottom of the bed there is an interbed (0.4 m) of clastic-oolitic limestones in which the trilobites are present - Bigotina sp., Hebediscus sp.

Member II.

Yellow, light-grey, white, coarsely crystalline, often with[a] poorly defined clastic structure, massive bedded dolostones, in places with[a] relict cross-laminated structure, medium parting. In the bed there are lense-like bodies up to 1-2 m and 2-3 m

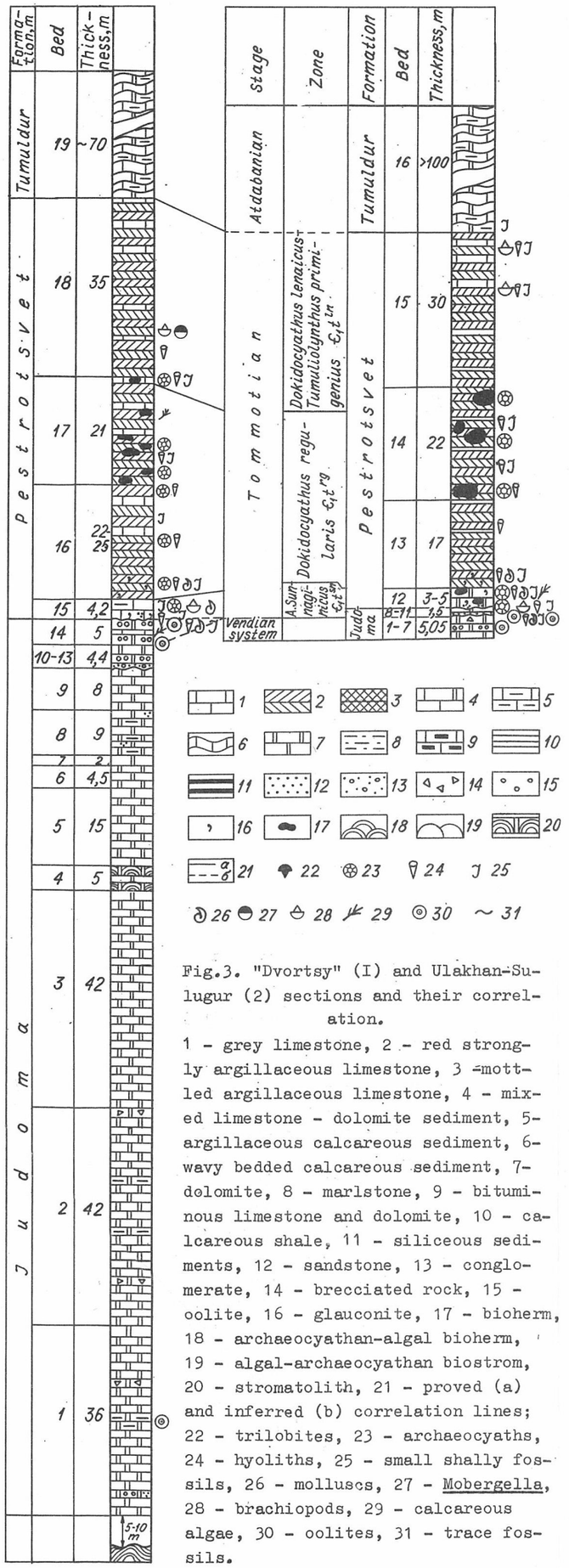


Fig.3. "Dvortsy" (I) and Ulakhan-Sulugur (2) sections and their correlation.

1 - grey limestone, 2 - red strongly argillaceous limestone, 3 - mottled argillaceous limestone, 4 - mixed limestone - dolomite sediment, 5 - argillaceous calcareous sediment, 6 - wavy bedded calcareous sediment, 7 - dolomite, 8 - marlstone, 9 - bituminous limestone and dolomite, 10 - calcareous shale, 11 - siliceous sediments, 12 - sandstone, 13 - conglomerate, 14 - brecciated rock, 15 - oolite, 16 - glauconite, 17 - bioherm, 18 - archaeocyathan-algal bioherm, 19 - algal-archaeocyathan biostrom, 20 - stromatolith, 21 - proved (a) and inferred (b) correlation lines; 22 - trilobites, 23 - archaeocyaths, 24 - hyoliths, 25 - small shally fossils, 26 - molluscs, 27 - Mobergella, 28 - brachiopods, 29 - calcareous algae, 30 - oolites, 31 - trace fossils.

Fig.4. Isit' (3) section.

Fig.5. Zhurinsky Mys (4) section.

Fig.6. Achchagy-Kyyry-Taas (8) section.

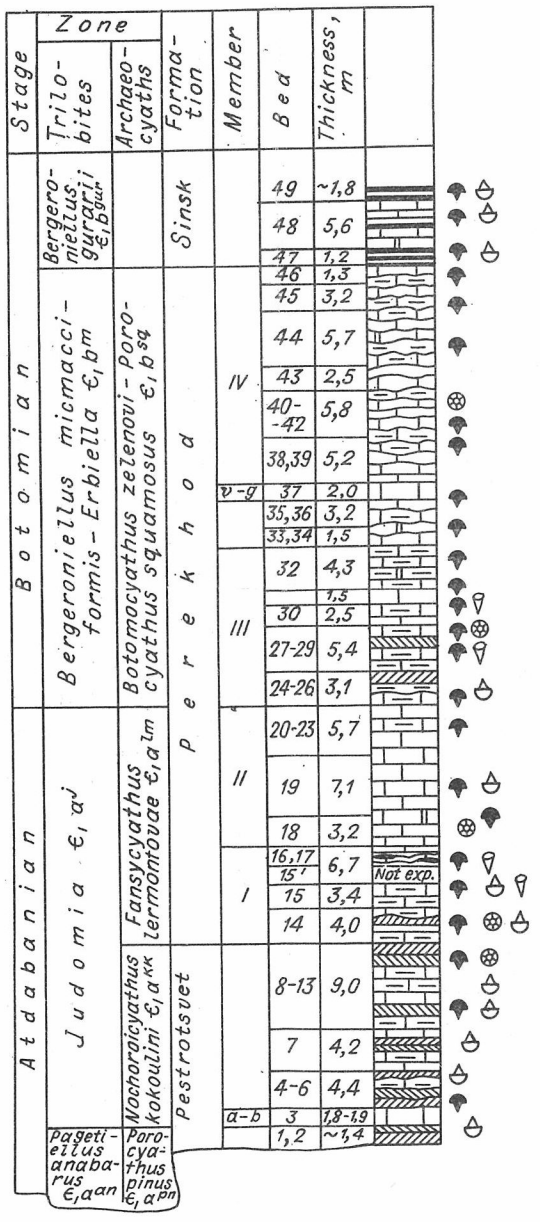


Fig.7. Ulakhan-Kyyry-Taas (9) section.

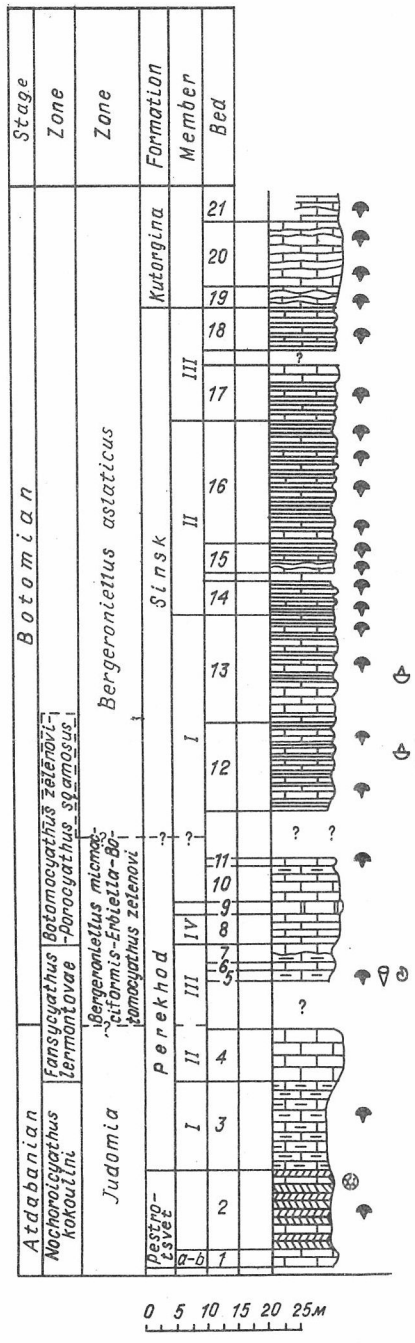


Fig.8. Achchagy-Tuoydakh section.

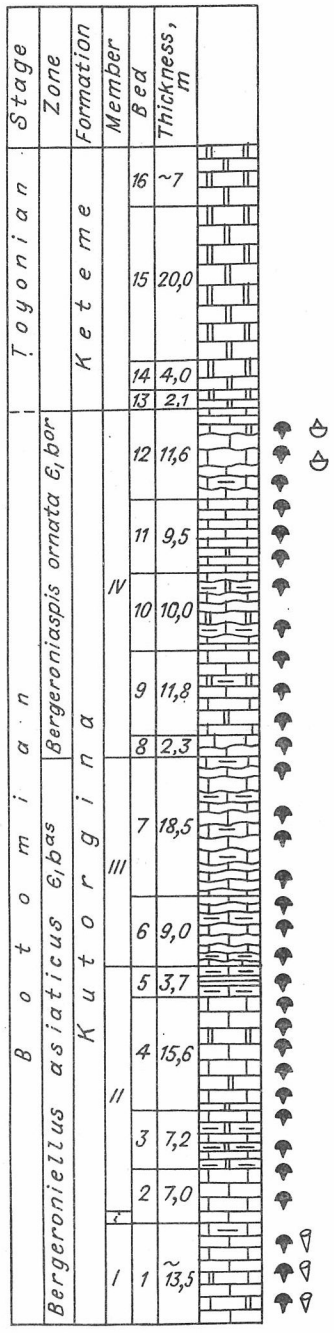
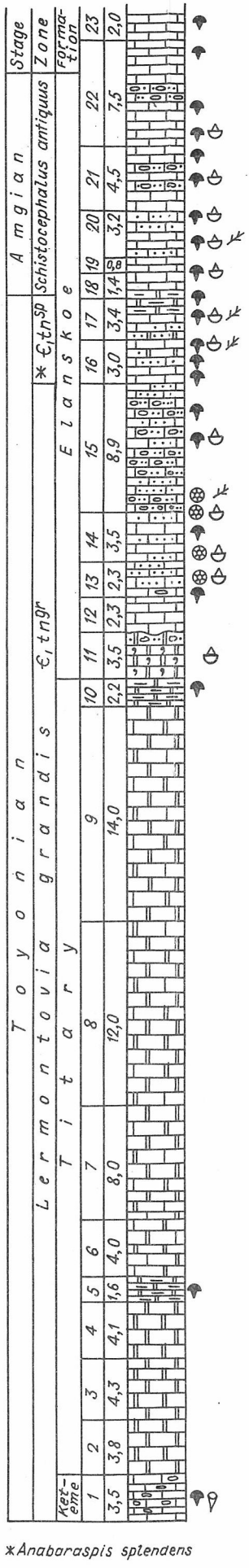


Fig.9. Labayya (12) section.



*Anabaraspis splendens

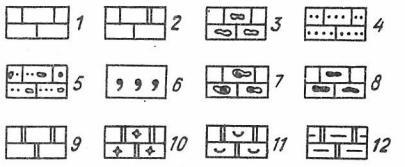


Fig.10. Section 19, 2.5 km upstream from Elanka Village. 1 - limestone, 2 - dolomitic and magnesian limestone, 3 - limestone with interbeds and lenses of dolomite, 4 - calcareous sandstone, 5 - calcareouse conglomerate and breccia-conglomerate, 6 - glauconite, 7 - limestone with calcite concretion, 8 - limestone with siliceous nodules, 9 - dolomite, 10 - porous-cavernous dolomite, 11 - dolomitic brachiopodan shell, 12 - argillaceous dolomite.

in diameter built by massive dolostones 26

10. Light-grey to white, in places yellowish-grey, algal-detrital, thick parting to massive, often dolomitic limestones interbedding with calcareous nonequigranular, unevenly dolomitic sandstones 2.5

2 m above the bottom of the bed the trilobites - Metadoxides patrium Rep., Bulaiaspis sp.

11. Dolostones the same as those of bed 9 with interbeds of grey limestones and calcareous sandstones 12

$\epsilon_1$bot^{lat} 12. White, light- and beige-grey, algal-detrital limestones and with non-distinct texture, sparse, thin interbeds of lens-shaped dolostones 11

3 m above the bottom of the bed the trilobites are found - Redlichina zhurinica Rep., Metadoxides patrium Rep., Bulaiaspis sajanica Rep.; 4 m above - Redlichina zhurinica Rep., 7 m - Metadoxides patrium Rep., Bulaiaspis limbata Rep.

Achchagyy-Kyyry-Taas (Section 8)

The section on the right bank of the Lena River near the Achchagyy-Kyyry-Taas Creek mounth. The section is the stratotype of the Judomia as well as the pinus, kokoulini and lermontovae Zones.

The lower beds (А-Г) of the Pestrotsvet Formation are exposed (Fig. 6) along the left bank of the Achchagyy-Kyyry-Taas Creek, 100 m from the mouth, 3,5 m above the water level of the Lena River.

Pestrotsvet Formation

thickness(m)

$\epsilon_1$atd^{anb}; atd^{pin} А. Biostromal, grey limestones with single small algal bioherms (the Bachyk Marker Bed). The diameter of single bioherms 0.5-1.0 m, the height - 0.3-0.5 m 0.5

The following archaeocyaths are defined - Tumuliolynthus ex gr. tubexternus (Vol.), Nochoroicyathus anabarensis (Zhur.), N.grandis Zhur., Leptosocyathus polyseptus (Latin), Arturocyathus varlamovi A.Zhur., Carinacyathus pinus (Zhur.), Geocyathus latini (Zhur.), Coscinocyathus isointervallumus Zhur.

Б. Argillaceous, dark-red - red, greenish-grey, sometimes mottled, flaggy limestones, interbedding with feebly argillaceous, grey and pink, aphanitic, often wavy bedded limestones.

Dark-red-red, argillaceous limestones are predominant in the upper part 3.6

At the base of the bed the trilobites - Pagetiellus anabarus Laz., Nevadiidae gen. et sp. indet.

In the upper part - Pagetiellus anabarus Laz., Nevadella sp.

All over the bed the brachiopods - Obolella chromatica Bill.

Б. Light-grey, aphanitic, massive limestones, with small algal bioherms at several levels 2

Г. Argillaceous, dark-red - and greenish-red, mottled limestones, with sparse interbeds of grey, feebly argillaceous limestones 1.2

The upper part of the section are in the cliff on the Lena River, where with the gap of 5.2 m (bed Д) the following beds (Fig. 6) are traced.

1. Light-grey, grey, pink, seldom mottled, fine-grained and aphanitic, thick parting and massive (up to 1 m) limestones, with subordinate interbeds of limestones dark-red - red, argillaceous, flaggy 7.2

1 m above the bottom of the bed the trilobites are found - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.); 2.5 and 5 m - Pagetiellus anabarus Laz.; all over the bed the brachiopods - Obolella chromatica Bill.; at the top of the bed the brachiopods - Sibiria magna Gor.

2. Light-grey, massive limestones with thin interbeds of dark-red-red, seldom greenish, argillaceous limestones. It is the marker bed "X-Y" (Khomentovsky, Repina, 1965) or the Chopchun Marker Bed (Rozanov, Missarzhevsky, 1966) 5

1 m above the bottom of the bed the trilobites occur - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.); 1.5 m above the bottom of the bed the trilobites - Pagetiellus anabarus Laz.; all over the bed the brachiopods - Obolella chromatica Bill.

3. Pink, mottled and light-grey, fine-grained, massive limestones 1.3

0.1 m above the bottom of the bed the trilobites - Pagetiellus anabarus Laz., Nevadella sp.

4. Light-grey, seldom pink, fine-grained, thin parting limestones with subordinate interbeds of limestones dark-red-red, argillaceous. Interbeds of mottled, brecciated limestones occur there sometimes 5.2

1.7 m above the bottom of the bed the trilobites - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.).

2 m above the bottom of the bed the archaeocyaths are found - Dokidocyathella incognita Zhur., Sibirecyathus suvorovae (Zhur.), Leptosocyathus polyseptus (Latin), Compositocyathus muchattensis Zhur., Carinacyathus pinus (Zhur.), Jakutocarinus jakutensis Zhur., Geocyathus botomaensis (Zhur.), Coscinocyathus isointervallumus Zhur.; the brachiopods - Obolella chromatica Bill.

At 2.9 m the trilobites - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.), Pseudoresserops oculatus Rep. and the hyoliths - Obliquatheca acostae Sys.

At the top of the bed the brachiopods are recorded - Obolella chromatica Bill.

5. Limestones with a varying amount of argillaceous content, usually red, thin parting, sometimes in rubble 2.5

0.55 m above the bottom of the bed the trilobites - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.).

1.17 m - Pagetiellus anabarus Laz.

At the top of the bed the hyoliths - Novitatus oblongus (Mesh.), Doliutus sp., Tetratheca clinisepta (Sys.), Burithes elongatus Miss., Obliquatheca acostae Sys.

All over the bed the brachiopods - Obolella chromatica Bill.

6. Light-grey, mottled, lumpy, thin bedded, massive limestones 1.6

0.5 m above the bottom of the bed the trilobites - Pagetiellus anabarus Laz., Nevadella subgroenlandica (Rep.), Pseudoresserops oculatus Rep., Bonnia sp., Compsocephalus generosus Rep., Dolichometopidae gen. et sp. indet.; the hyoliths - Obliquatheca acostae Sys.; the brachiopods - Obolella chromatica Bill.

7. Argillaceous, red, flaggy limestones, interbedding with grey and mottled, aphanitic and fine-grained, thick parting, sometimes organogenous-clastic limestones 8

At the bottom of the bed the trilobites - Pagetiellus anabarus Laz.; the archaeocyaths - Dokidocyathella incognita (Zhur.), Sibirecyathus suvorovae (Zhur.), Leptosocyathus polyseptus (Latin), Compositocyathus muchattensis Zhur., Carinacyathus pinus (Zhur.), Jakutocarinus jakutensis Zhur., Geocyathus botomaensis (Zhur.), Coscinocyathus isointervallumus Zhur.

All over the bed the brachiopods - Obolella chromatica Bill. and the hyoliths - Burithes elongatus Miss.

$\epsilon_1$atd^{jud}, atd^{kok} 8. Light-grey, sometimes feebly pinkish, aphanitic, massive limestones. This bed is choosen as the marker bed "а-б" (Khomentovsky, Repina, 1965) or the Sakkyryr Marker Bed (Rozanov, Missrazhevsky, 1966) 2

In the bed the hyoliths are defined - Doliutus inflatus (Sys.) and the algae - Proaulopora glabra Krasnop., Batinevia ramosa Korde, Girvanella problematica Nich. et Ether.

9. Grey, fine-grained and aphanitic, medium parting limestones interbedding (in 0.2-0.3 m) with red, argillaceous thin parting limestones 2.7

At the bottom of the bed the trilobites - Judomia sp.

1.5 m above the bottom of the bed the hyoliths - Doliutus inflatus (Sys.) and the brachiopods - Obolella chromatica Bill.

10. Strongly argillaceous, dark-red-red, in places greyish-brown, sometimes in rubble, thick-bedded limestones 0.7

The trilobites are found - Judomia sp. and the hyoliths - Doliutus inflatus (Sys.).

11. Light-grey, pink and lilac, fine-grained, thick-parting limestones interbedding with subordinate interbeds of dark-red-red, argillaceous limestones, sometimes in rubble 3.4

In grey limestones the algae are recorded - Proaulopora glabra Krasnop., Subtifloria delicata Masl.

In the medium part the trilobites - Judomia mattajensis Laz., Pagetiellus sp. and the archaeocyaths - Plicocyathus unicumus (Zhur.), Squamosocyathus taumathus Zhur., Nochoroicyathus kokoulini Korsh., Lenocyathus lenaicus Zhur.; the brachiopods - Obolella chromatica Bill. and the hyoliths - Doliutus inflatus (Sys.).

12. Feebly argillaceous, grey and pink, medium-grained, wavy bedded, massive limestones with sparse interbeds of dark-

red-red, argillaceous, thin parting limestones 3.4

0.2 m above the bottom of the bed there are the trilobites - Pagetiellus lenaicus (Toll), Triangulaspis meglitzkii (Toll), Judomia sp.

0.3 m above the bottom of the bed and at the top the trilobites - Pagetiellus lenaicus (Toll), Olenellidae gen. et sp. indet.

13. Strongly argillaceous, dark-red-red, seldom pink, flaggy, fissile limestones with single bands of grey, mottled, feebly argillaceous limestones 1.5

0.5 m above the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll).

All over the bed the brachiopods - Obolella chromatica Bill.

14. Light-grey, fine-grained, massive limestones 2

The brachiopods are found - Obolella chromatica Bill.

15. Dark-red-red, sometimes mottled, medium- and thin-parting limestones with a varying amount of argillaceous content 2.5

0.5 m above the bottom of the bed the trilobites occur - Pagetiellus lenaicus (Toll) and the brachiopods - Sibiria magna Gor.

16. Dark-red-red, mottled, thin parting limestones with a varying amount of argillaceous content 2

The brachiopods are recorded - Obolella chromatica Bill.

17. Grey, brown, sometimes with wine-coloured (deep-red) spots, fine-grained, massive, often thin-uneven bedded limestones with abundant interbeds (0.3 to 0.7 m) of argillaceous, greenish-grey, more seldom dark-red-red, thin-bedded limestones, sometimes in rubble 4.5

0.7 m above the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll), Triangulaspis lermontovae Laz., Judomia sp.

2.3 m - the trilobites - Judomia tera Laz.

All over the bed the brachiopods - Sibiria magna Gor.

Perekhod Formation

Member I

$\in_1$atd^{ler} 18. Strongly argillaceous greenish-grey, seldom

reddish, thin-bedded, flaggy limestones, with a conchoidal break and interbeds of feebly argillaceous, grey, thin parting limestones 7

0.3 m above the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll), Judomia sp.

4.2 m-the trilobites - Pagetiellus lenaicus (Toll), Olenellidae gen. et sp. indet.

All over the bed the hyoliths - Lenatheca dolosa Sys., L. groenlandica (Poul.), Doliutus laevis Mesh., Conotheca circumflexa Miss.; the algae - Proaulopora glabra Krasnop. At the base of the bed the algal bioherms with the archaeocyaths: Propriolynthus vologdini (Jak.), Geocyathus latini (Zhur.), Batchykicyathus angulosus A.Zhur., Nochoroicyathus kokoulini Korsh., Tumulocoscinus botomaensis Korsh., Fransuasaecyathus elegans Okun.

19. Greenish-grey, flaggy limestones with mounds on the bedding surface and algal bioherms up to 0.5 m in diameter 8

In the bioherms the following archaeocyaths are defined - Plicocyathus unicumus (Zhur.), Squamosocyathus taumatus Zhur., Nochoroicyathus kokoulini Korsh., N. lenaicus Zhur., Japhanicyathus genurosus Korsh., Tumuliolynthus tubexternus (Vol.), Rotundocyathus sp., Propriolynthus vologdini (Jak.), Isiticyathus ultrus (Korsh.), Fallocyathus sp., Geocyathus latini (Zhur.), Coscinocyathus isointervallumus Zhur.; the hyoliths - Conotheca curta Miss., Lenatheca dolosa Sys., L. groenlandica (Poul.); the algae - Epiphyton scapulum Korde.

Member II

20. Light-grey to white, fine-grained, shally, massive limestones, with sparse interbeds of greenish-grey, argillaceous limestones about 16

At the bottom of the bed the algae - Renalcis levis Vol.

4 m above the bottom the trilobites - Bonnia sp., Botomella sp.

4 and 6 m above the bottom and at the top of the bed the archaeocyaths - Compositocyathus muchattensis (Zhur.), Carinacyathus pinus (Zhur.), Coscinocyathus isointervallumus Zhur., Japhanicyathus genurosus Korsh., Isiticyathus ultrus (Korsh.), Fansycyathus lermontovae Korsh. et Roz.

10 m above the bottom the trilobites - Pagetiellus sp.; the algae - Botomaella sp., Proaulopora glabra Krasnop., Girvanella problematica Nich. et Ether.

At the top the algae - Epiphyton plumosum Korde.

All over the bed the hyoliths - Doliutus laevis Mesh., Plicitheca inflecta Sys., Lenatheca groenlandica (Poul.); the brachiopods - Sibiria magna Gor.; the SSF - Hadimopanella knappoľogica (Bengt.).

20. Not exposed 10-12

Member III

$\epsilon_1$bot^{mic} 21. Argillaceous, greenish-grey, flaggy limestones about 7

All over the bed the trilobites - Triangulaspis annio (Cobb.), Pagetiellus lenaicus (Toll), Neocobboldia dentata Rep., Judomia sp., Erbiella pjankovskia Fed., E.musta Rep., Validaspis uzitata (Rep.).

At the bottom of the bed the hyoliths - Tetratheca clinisepta (Sys.), Lenatheca groenlandica (Poul.), L.dolosa Sys., Trapezovitus sinscus Sys., Burithes elongatus Miss.; the molluscs - Ilsanella atdabanica (Miss.), Pelagiella lorenzi(Kob.), Yochelcionella stylifera Miss.; the SSF - Lapworthella dentata Miss., Hadimopanella knappologica (Bengt.), Archaeocoides ? lenensis (Vasil'eva), Microdictyon sp.; archaeocyaths - Coscinocyathus sp.

The algae in the middle part of the bed - Proaulopora glabra Krasnop., Batinevia remosa Korde, Girvanella problematica Nich. et Ether.

Ulakhan-Kyyry-Taas (Section 9)

The section is on the right bank of the Lena River, 1.5km downstream the Ulakhan-Kyyry-Taas Creek. This section is the stratotypic one for the micmacciformis - Erbiella and squamosus - zelenovi Zones.

At 20 m from the water level the Pestrotsvet, Perekhod and the lower part of the Sinsk Formation are exposed (Fig.7).

Pestrotsvet Formation

thickness (m)

$\epsilon_1$atd^{pin}, atd^{anb} 1-2. Strongly argillaceous, red-greyish-brown, bedded, flaggy limestones about 1.4

The brachiopods are found - Obolella chromatica Bill.

$\epsilon_1$atd^{jud}; atd^{kok} 3. Light-grey, striped, massive limestones, mottled in some interbeds (marker bed "а -б ", Sakkyryr) 1.8-1.9

4-6. Limestones with a varying amount of argillaceous content, reddish-greyish-brown and ruddy-red-red, seldom greenish-grey, mottled, thin-uneven-parting 4.4

0.8 m above the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll), Judomia sp.

2.5 m - the brachiopods - Obolella chromatica Bill.

All over the bed the hyoliths - Lenatheca pyramidata (Sys.), Doliutus ingfatus (Sys.).

7. Feebly argillaceous, light-pink, greyish-pink, lilac, mottled, flaggy limestones, with thin argillaceous admixtures on the bedding surface. Sparse interbeds of argillaceous, red limestones 4.2

The brachiopods are defined - Obolella chromatica Bill.

8-13. Interbedding of feebly argillaceous, pinkish- and lilac-grey, grey mottled, sometimes lenticular, massive and thick parting limestones with strongly argillaceous, ruddy-red-red, thin parting limestones. The mentioned varieties of rocks comprise interbeds of approximately 1.5 m in size 9

2.8 m above the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll), Judomia sp.

At 2 m from the top the archaeocyaths - Sibirecyathus sp., Carinacyathus pinus (Zhur.), Compositocyathus muchattensis Zhur., Bronchocyathidae gen. et sp. indet., Lenocyathus sp., Coscinocyathus isointervallumus Zhur.

At the top the trilobites - Bonnia aff. arguta Rep., Olenellidae gen. et sp. indet.

All over the bed the brachiopods - Obolella chromatica Bill.

Perekhod Formation

Member I

$\epsilon_1$atd^{ler} 14. Argillaceous, yellowish- and greenish-grey limestones with sparse interbeds of feebly argillaceous, pinkish-grey and argillaceous reddish-greyish-brown limestones 4

At the bottom of the bed the trilobites - Pagetiellus sp., Triangulaspis sp. and the archaeocyaths - Sibirecyathus sp., Carinacyathus pinus (Zhur.), Compositocyathus muchattensis Zhur., Lenocyathus sp., Coscinocyathus isointervallumus Zhur.

At the top the trilobites - Pagetiellus lenaicus (Toll), Olenellidae gen. et sp. indet.; all over the bed the brachiopods - Sibiria magna Gor.

15. Argillaceous, greenish-, seldom reddish-grey, dense, with a conchoidal break, ochreous from the weathered surface, flaggy limestones 3.4

At the bottom of the bed the brachiopods - Obolella chromatica Bill.

At the top - the trilobites - Pagetiellus lenaicus (Toll), Judomia sp.; the hyoliths - Lenatheca dolosa Sys., L. groenlandica (Poul.), Tetratheca clinisepta (Sys.), Novitatus laevis Sys., Obliquatheca acostae Sys., Angusticornus acutangulus Sys., Firmicornus bonus Sys.

16. Not exposed 3.2

17,18. Greenish-grey, dense, massive limestones. In the member there are algal breccias of small sizes 3.5

At the bottom of the bed the trilobites are recorded - Pagetiellus lenaicus (Toll), Judomia sp. and the hyoliths - Trapezovitus sinscus Sys., Lenatheca dolosa Sys., L. groenlandica (Poul.).

Member II

19. Light-grey, massive, thin, striped limestones with interbeds of dolomitic, yellowish-grey limestones 3.2

1.2 m above the bottom of the bed the trilobites - Triangulaspis lermontovae Laz., Pagetiellus lenaicus (Toll), Botomella sp., Judomia sp.

2 m - the archaeocyaths - Propriolynthus vologdini (Jak.), Nochoroicyathus kokoulini Korsh., Tumulocyathus sp., Plicocyathus platiseptatus (Zhur.), Geocyathus sp., Tumulocoscinus atdabanensis Zhur.

20. Greenish-grey, dense, fine-grained to aphanitic, massive and fine-fibrous-striped limestones 7.1

At the bottom of the bed the trilobites - Pagetiellus lenaicus (Toll), Judomia sp., Bonnia sp., Dolichometopidae

gen. et sp. indet.; the brachiopods - Sibiria magna Gor., the hyoliths - Lenatheca pyramidata (Sys.), L. triconcava (Sys.), Obliquatheca acostae Sys., Trapezovitus sinscus Sys., T. latus Val., Angusticornus acutangulus Sys., Firmicornus bonus Sys.

At the top the trilobites - Pagetiellus lenaicus (Toll), Judomia sp., Triangulaspis sp., Micmacca sp.

21-24. Limestones similar to the underlying but comprising interbeds of greenish-grey, argillaceous limestones 5.7

2.5 m above the bottom of the bed the trilobites - Triangulaspis sp., Bonnia aff. arguta Rep., Judomia sp.

Member III

$\epsilon_1 bot^{mic}$; bot^{zel} 25-27. Argillaceous, greenish-grey, in the upper part reddish-greyish-brown, fine-grained, uneven-flaggy limestones 3.1

At the bottom of the bed the trilobites - Judomia sp., Pagetiellus lenaicus (Toll), Neocobboldia sp.

1.5 m above the base the trilobites - Pagetiellus lenaicus (Toll), Triangulaspis lermontovae Laz., T. annio (Cobb.), Sinskia obtabilis Suv., Micmacca enormis Rep., Kootenia nebulosa Rep., Granularia sp., Atdabanella plana Rep., Bonnia venefica Rep., Erbiella sp.

All over the bed the brachiopods - Sibiria magna Gor.; the hyoliths - Tetratheca clinisepta (Sys.), Novitatus laevis Sys., Lenatheca dolosa Sys., Angusti-cornus reflexus Sys., A. remotus Sys., Firmicornus obliteratus Sys.

28-30. Argillaceous, mainly greenish-grey, in some interbeds reddish-greyish-brown, uneven-flaggy limestones, often with a conchoidal break. Sparse interbeds of feebly argillaceous limestones 5.4

At the bottom of the bed the trilobites - Judomia sp., Pagetiellus sp., Neocobboldia sp.

1.5 m above the base the trilobites - Neocobboldia dentata Rep., Judomia sp., Bonnia venefica Rep., Kootenia sp.

2-2.5 m - Neocobboldia sp., Triangulaspis sp., Judomia sp., Atdabanella plana Rep., Granularia sp., Erbiella sp.; 3 m - the trilobites - Neocobboldia paradentata Rep., Bonnia venefica Rep., Kootenia nebulosa Rep., Granularia sp., Binodaspis sp.; the archaeocyaths - Rotundocyathus biohemicus (Zhur.), Nochoroi-

cyathus ex gr. lenaicus Zhur., Jakutocarinus ? sp., Geocyathus botomaensis (Zhur.), Tumulocoscinus sp.; the hyoliths - Tetratheca clinisepta(Sys.), Novitatus lermontovae Sys., N.tarynicus Sys., Micatheca ancipitia (Sys.), Gracilitheca ternata Sys., Inflaticornus strigatus Sys., Trapezovitus sinscus Sys.

31. Argillaceous, greenish-grey, flaggy limestones with a conhoidal break and sparse interbeds of feebly argillaceous, light grey limestones 2.5

At the bottom of the bed the trilobites - Neocobboldia paradentata Rep., N.dentata (Lerm.), Triangulaspis lermontovae Laz., Judomia sp., Micmacca enormis Rep., Atdabanella plana Rep., Kootenia sp., Protolenidae gen. et sp. indet. and the hyoliths - Novitatus lermontovae Sys.

1.5 m above the bottom of the bed the trilobites - Neocobboldia dentata (Lerm.), Judomia sp.; 2 m - Pagetiellus lenaicus (Toll), Judomia sp., Judomiella heba Laz., Bonnia venefica Rep.

At the top of the bed - Pagetiellus lenaicus (Toll), Judomia sp.

32. Feebly argillaceous, light-grey, sucrosic limestones 1.5

All over the bed the trilobites - Hebediscus attleborensis (Sh. et F.), Neocobboldia dentatus (Lerm.), Triangulaspis annio (Cobb.), Judomia sp., Judomiella sp., Redlichina tchernischevae Rep., Bergeroniaspis jucunda Rep., Aldonaia pokrovskayae Kor., Micmacca enormis Rep., Micmaccopsis lata Rep., Kootenia sp., Bonnia venefica Rep., Atdabanella plana Rep., Validaspis uzitata (Rep.), Inouyina sp., Granularia muchattaensis Rep., Poulsenia sp., Erbiella pjankovskia Fed., E.musta Rep.

33. Dolomitic, greenish-grey, thin-parting limestones. The upper part of the bed is poorly exposed 4.3

In the lower part of the bed the trilobites - Neocobboldia paradentata Rep., Pagetiellus lenaicus (Toll), Triangulaspis annio (Cobb.), Judomia sp., Aldonaia pokrovskayae Kor., Granularia sp.

In the middle part the trilobites - Neocobboldia dentata Rep.

Member IV

34,35. Dolomitic, feebly argillaceous, light-brown,"grit",

in places oolitic, organogenous-clastic, massive limestones 1.5

The trilobites are found - Judomia sp., Judomiella sp.; the archaeocyaths - Propriolynthus vologdini (Jak.), Batchykicyathus angulosus A.Zhur., Nochoroicyathus lenaicus Zhur., Tumulocyathus sp., Plicocyathus platiseptatus (Zhur.), Fallocyathus dubius Roz., Erismacoscinus vsevolodi (Korsh.).

36,37. Dolomitic, brownish, dense, in some interbeds striped and sucrosic limestones 3.2

There are the trilobites in the bed - Pagetiellus lenaicus (Toll), Neocobboldia dentata (Lerm.), N.paradentata Rep., Judomia sp., Judomiella heba Laz., Sinskia obtabilis Suv., Redlichina tchernischevae Rep., Bergeroniaspis dualis Jegor., Micmaccopsis lata Rep., Kootenia nebulosa Rep., Chondrinouyina olekmica Rep., Inouyina sp., Tarynaspis brevis Rep., Jakutus sp., Granularia sp., Binodaspis sp., Erbiella pjankovskia Fed.

38. Greyish-yellow, massive, dense dolostones. That bed was defined by Khomentovsky and Repina (1965), as the Marker Bed " в-г " 2

39,40. Light-brown, fine-grained, thick parting, dense, with uneven bedding surface limestones 5.2

In the middle part of the bed the trilobites - Neocobboldia paradentata Rep., N.dentata (Lerm.), Judomia sp., Triangulaspis annio (Cobb.), Judomiella sp., Redlichina tchernischevae Rep., Bergeroniellus micmacciformis Suv., Bergeroniaspis dualis Jegor., Erbiella pjankovskia Fed., Atdabanella plana Rep., Granularia muchattaensis Rep.; the brachiopods - Palaeoschmidtites siniellus (Pelm.), Linnarssonia rowelli Pelm.; the molluscs - Ilsanella sp.

In the upper part - Neocobboldia paradentata Rep., Bergeroniellus micmacciformis Suv., Granularia sp.

41-43. Light-brown, medium- and thin parting limestones, in some interbeds lumpy, concretion-like, with a wavy bedding surface. Sparse thin interbeds of greyish-yellow dolomites are recorded 5.8

At the bottom of the bed the trilobites are defined - Neocobboldia paradentata Rep., Lenadiscus unicus Rep., Pagetiellus lenaicus (Toll), Judomia sp., Judomiella heba Laz.,

Redlichina tchernischevae Rep., Tungusella manica Rep., Bergeroniellus micmacciformis Suv., B. spinosus Lerm., Bergeroniaspis dualis Jegor., Aldonaia pokrovskayae Kor., Micmaccopsis lata Rep., Labradoria asiatica Rep., Kootenia nebulosa Rep., Bonnaria sp., Atdabanella plana Rep., Chondrinouyina olekmica Rep., Inouyina sp., Tarynaspis brevis Rep., Granularia protolenorum Lerm., Kolbinella sp., Binodaspis sp., Sinijanella rara Rep., Erbiella pjankovskia Fed.

In the medium part the archaeocyaths - Archaeolynthus sp., Carinacyathus squamosus (Zhur.), Plicocyathus sp., Nochoroicyathus lenaicus Zhur., Trininaecyathus sp., Coscinocyathus marocanoides Zhur., Rozanovicyathidae gen. et sp. indet.; the brachiopods - Palaeoschmidtites siniellus (Pelm.), Linnarssonia rowelli Pelm.

In the upper part the trilobites - Bergeroniellus spinosus Lerm., Aldonaia pokrovskayae Kor., Judomiella heba Laz., Bathyuriscellus aff. robustus Lerm., Altitudella tenera Rep.

44-46. Brownish-grey, bedded, with wavy bedding surface, thin-parting limestones, with thin interbeds of grey dolomites 11.4

4 m above the bottom of the bed the trilobites - Bergeroniellus micmacciformis Suv., Judomiella sp.

In the medium part the trilobites - Neocobboldia paradentata Rep., Pagetiellus lenaicus (Toll), Bergeroniellus micmacciformis Suv., B. spinosus Lerm., Aldonaia pokrovskayae Kor., Judomiella heba Laz.

In the upper part the trilobites - Pagetiellus lenaicus (Toll), Judomiella heba Laz., Bergeroniellus micmacciformis Suv., B. spinosus Lerm., Bergeroniaspis dualis Jegor.

47. Light-brown, thin-parting limestones interbedding with schistose limestones of darker brown colour 1.3

In the medium part the trilobites - Bergeroniellus micmacciformis Suv.

Sinsk Formation

$\in_1$bot^{gur} 48. Argillaceous-siliceous-calcareous shales, in the upper part dark-brown, with sparse interbeds of aphanitic, brown limestones 1.2

At the bottom of the bed the trilobites - Pagetiellus

lenaicus (Toll), Neopagetina primaeva (Lerm.), Bergeroniellus gurarii Suv., B. spinosus Lerm., Bergeroniaspis lenaicus Laz.; the brachiopods - Botsfordia caellata (Hall), Lingulella? sp.

At the top the trilobites - Pagetiellus lenaicus (Toll), Bergeroniellus gurarii Suv., B. spinosus Lerm., Neopagetina primaeva (Lerm.).

47. Brownish-grey, thin parting limestones with interbeds of argillaceous-calcareous paper shales and grained, greyish-yellow dolostones 5.6

At the bottom of the bed the trilobites - Bergeroniellus spinosus Lerm., B. gurarii Suv., Pagetiellus lenaicus (Toll), P. tolli Lerm., Neopagetina sp.

2 m above the bottom of the bed the trilobites - Bergeroniellus gurarii Suv., B. spinosus Lerm., Bathyuriscellus sp., Pagetiellus sp.

4 m - the trilobites - Bergeroniellus gurarii Suv., B. spinosus Lerm., Bergeroniaspis lenaica Laz., Pagetiellus lenaicus (Toll).

At the top of the bed the trilobites - Bergeroniellus gurarii Suv., B. spinosus Lerm., Pagetiellus lenaicus (Toll), Bergeroniaspis lenaica Laz., Neopagetina primaeva (Lerm.).

All over the bed the brachiopods - Botsfordia caelata (Hall), Palaeoschmidtites siniellus (Pelm.), Linnarssonia rowelli Pelm.

50. Argillaceous-siliceous-calcarecus shales and dark-brown to black, thin-bedded limestones 1.8

All over the bed the trilobites - Bergeroniellus gurarii Suv., B. spinosus Lerm., Bergeroniaspis sp., Pagetiellus tolli Laz., Neopagetina sp.; the brachiopods - Botsfordia caelata (Hall), Palaeoschmidtites siniellus (Pelm.), Linnarssonia rowelli Pelm.

Achchagyy-Tuoydakh

The section is exposed on the right bank of the Lena River, 2.5-3 km below the Achchagyy-Tuoydakh Creek mouth (Fig. 8).

Here, at 1 m from the water level exposed are:

Pestrotsvet Formation

thickness(m)

$\epsilon_1$atd^{jud} 1. Light-grey, in places pink, fine-grained

and aphanitic, massive limestones (bed " а-б ") 2.5

0.5 km upstream the section, 7.7 m below the marker bed there is a biostrom with archaeocyaths.

2. Frequent interbedding of dark-red-red, thin and medium parting, wavy bedded limestones, with a varying amount of argillaceous content, with grey and pinkish, feebly argillaceous limestones 12.5

4.1 m above the bottom the trilobites: Pagetiellus lenaicus (Toll), Judomia sp.

Perekhod Formation

Member I

3. Greenish-grey, seldom mottled, with reddish spots and faded cherry-red, strongly argillaceous, with a conchoidal break limestones 14

10 m above the bottom the trilobites: Pagetiellus lenaicus (Toll), Judomia sp.

Member II

4. Light-grey, sometimes greenish or pinkish, massive, fine-fibrous-bedded limestones 7.8

8 m are not exposed.

Member III

$_1$bot^{mic} 5. Greenish-grey, strongly argillaceous, medium-parting limestones with a conchoidal break 0.7

All over the bed the trilobites: Pagetiellus lenaicus (Toll), Judomia sp.; the SSF : Archaeooides ? lenensis (Vasil'eva), A. ? improsperus (Vasil'eva).

6. Light-grey to white, medium-grained, massive limestones 0.7

7. Greenish-grey, argillaceous, thick-parting and massive limestones with interbeds of pinkish and brownish, strongly argillaceous, thin wavy bedded limestones 2.95

Member IV

8. Light-grey to white, fine- and medium grained, massive, fine wavy bedded limestones 4.5

9. Greyish-yellow, ochreous from the weathered surface, massive dolostones, with a conchoidal break (marker bed " в-г ") 1.5

10. Light-grey and brownish-grey, fine-grained, massive, thin wavy bedded limestones. In the upper part dolomitic,

flaggy limestones 5.5

11. Mottled, grey, pinkish-brown, flaggy limestones with a wavy bedding surface 1.35

10 m above the bottom the trilobites occur: Pagetiellus lenaicus (Toll), Neocobboldia paradentata Rep., Judomia sp., Bergeroniellus micmacciformis Suv., Granularia sp., Redlichina sp.

7.7 m are not exposed.

Sinsk Formation

Member I

$\epsilon_1$bot^{gur} 12. Light-brown and brown, fine-grained and aphanitic, mainly medium-parting limestones, containing interbeds of shally striped and dark-brown to black, sometimes bituminous shales (the thickness 0.1-0.15 m).

Apparent thickness 14

All over the bed the trilobites: Pagetiellus lenaicus (Toll), Neopagetina primaeva (Lerm.), Bergeroniellus gurarii Suv., B. spinosus Lerm., Bergeroniaspis divegens Lerm.

13. Dark-brown, thin parting, with wavy bedding surfaces limestones. Interbeds of black bituminous paper shales occur which thickness reaches 0.5 m in the lower part but decreases to 0.05-0.10 m in the upper part 17

In the medium and upper parts the trilobites occur: Pagetiellus lenaicus (Toll), Neopagetina sp., Bergeroniellus asiaticus Lerm.

Member II

14. Black, bituminous, paper shales, containing thin interbeds of dark-brown and thin parting limestones.

Apparent thickness 4.5

1.2 and 2 m above the bottom the trilobites: Pagetiellus lenaicus (Toll), Bergeroniellus gurarii Suv., B. spinosus Lerm., Bergeroniaspis divergens Lerm.

0.85 m is not exposed.

15. Dark-brown, fine-grained, thick parting and massive limestones interbedding with units (0.1-0.3 m) of black paper shales. At the bottom there are beds with loaf-like swells up to 0.5 m in height 4.9

1 and 3 m above the bottom there are the trilobites :

Pagetiellus lenaicus (Toll), P. tolli Lerm., Bergeroniellus spinosus Lerm., Bergeroniaspis divergens Lerm.

16. Black and dark-brown, bituminous paper shales with of limestone dark-brown, fine-grained, thick parting interbeds 19

All over the bed there are abundant trilobites: Pagetiellus lenaicus (Toll), Neopagetina primaeva (Lerm.), Bergeroniellus spinosus Lerm., Bergeroniaspis divergens Lerm.; the algae: Margaretia antiquissima (Krischtofovich); the sponges: Choia unica (Gor.).

2 m above the bottom of the bed the annelides - Palaeoscolecidae gen. et sp. indet.

Member III

17. Light-brown and brown, often striped, fine-grained, aphanitic, thin parting limestones, interbedding with shales, and shally brown limestones 8.5

All over the bed the trilobites: Pagetiellus lenaicus (Toll), Neopagetina primaeva (Lerm.), Bergeroniellus spinosus Lerm.

2.5 m is not exposed.

18. Black shales, in some interbeds paper shales, containing bands of fine-grained, thin parting limestones 6.6

All over the bed the trilobites: Neopagetina sp., Bergeroniellus asiaticus Lerm.

The Kutorgina Formation

$\mathcal{E}_1$bot^{ast} 19. Light-brown, fine-grained, thin parting limestones, interbedding with thick parting limestones forming swells 3.3

At 1.5 and 2.5 m from the bottom the trilobites: Bergeroniellus asiaticus Lerm., Bergeroniaspis ornata Suv.

20. Fine-greined, light-brown, medium parting limestones with^{a} wavy bedding surface, uneven interbeds of greyish-yellow dolomitic limestones. In the middle of the bed there is an interbed (1 m) of dark-brown, flaggy limestones with oil smell 10

All over the bed the trilobites: Neopagetina primaeva (Lerm.), Bergeroniellus asiaticus Lerm.; and, besides, at 1 m from the top: Pagetiellus lenaicus (Toll), Aldonaia ornata

Lerm., Binodaspis secunda Suv. At 5 m above the bottom plates of echinoderms and carapaces of crustaceans are recorded.

21. Semi-bedrock outcrops of light-brown, coarse-grained, sucrosic, medium parting limestones 4

The trilobites are present: Neopagetina primaeva (Lerm.), Bergeroniellus asiaticus Lerm., Binodaspis sp.

Labaya (Section 12)

The section is on the Lena River right bank, 4 km below the Labaya Creek. Bedrock outcrops known as "Lenskie stolby" (Lena Columns) stretch for dozens kilometres along the river bank.

In this section the stratotype of the ornata Zone is defined (beds 8-12).

Here, from the water level, exposed are deposits of the Kutorgina Formation and the lower part of the Keteme Formation (Fig. 9).

The Kutorgina Formation

thickness(m)

Member I

ϵ_1 bot^{ast} 1. Light- and dark-brown, fine-grained and aphanitic, flaggy limestones. Tiles of 0.03-0.05 m in size predominate; interbeds of thin parting limestones are sparse. Limestones are interbedding with thin (up to 0.01 m) bands of dolostones of yellowish-grey colour about 13.5

All over the bed abundant trilobites - Bergeroniellus asiaticus Lerm.; the hyoliths - Obliquatheca pulchella Val.

Member II

2. Brownish, aphanitic, dense, medium parting limestones. At the bottom there is a marker bed "и" with vertical jointing 7

All over the bed the trilobites - Neopagetina sp., Binodaspis sp., Bergeroniellus asiaticus Lerm.

3. Brownish, aphanitic and fine-grained, thin parting limestones with frequent, thin (thick in the upper part) interbeds of greyish-yellow dolostones 7.2

All over the bed the trilobites - Bergeroniellus asiaticus Lerm., B. expansus (Lerm.), Binodaspis secunda Suv.

4. Dolomitic, brownish, aphanitic, compact limestones with interbeds of yellow dolostones 15.6

0.1 m above the bottom of the bed the trilobites - Bergeroniellus asiaticus Lerm., Bergeroniaspis kutorginorum Lerm.; 3 m - Bergeroniellus asiaticus Lerm.; 5 m - Bergeroniellus asiaticus Lerm., B.spinosus Lerm.; 7 m - Neopagetina primaeva Lerm., Bergeroniellus asiaticus Lerm., Binodaspis secunda Suv., Bathyuriscellus sp.; 8 m - Bergeroniellus asiaticus Lerm.; 11 and 14 m - Bergeroniellus asiaticus Lerm., B.lermontovae Suv.

5. Dark-brown, fine-grained, medium-parting limestones with a conchoidal break interbedding with calcareous shales and shally, greenish-grey, argillaceous limestones (interbeds 0.1-0.15 m) 3.7

2 m above the bottom of the bed the trilobites - Bergeroniellus asiaticus Lerm.

Member II

6. Light-brown, aphanitic limestones, thin parting in the lower part and medium parting in the upper part of the bed, with a wavy bedding surface and thin stringers of greyish-yellow dolostones on them 9

All over the bed the trilobites - Bergeroniellus asiaticus Lerm. Besides, at the bottom Bergeroniaspis divergens Lerm. occurs and in the medium part - Pagetiellus lenaicus (Toll) and Binodaspis paula Suv.

7. Argillaceous, light-brown, thin- and medium parting limestones with a wavy bedding surface, interbeds of strongly argillaceous, yellowish limestones with a conchoidal break 18.5

At the bottom of the bed the trilobites - Bergeroniellus asiaticus Lerm., B.expansus (Lerm.). In the medium part - Neopagetina aff. primaeva (Lerm.), Bergeroniellus asiaticus Lerm., B.lermontovae Suv. In the upper part - Neopagetina sp., Bergeroniaspis sp., Bergeroniellus asiaticus Lerm., B.lermontovae Suv.

Member IV

ϵ_1 bot^{orn} 8. Light-brown to yellow limestones. The bed contains concretions at the base and lumpy, algal and organogenous-clastic interbeds of limestones with stylolitic sutures in the upper part 2.3

All over the bed the trilobites - Pagetia sp., Bergeroniellus asiaticus Lerm., Bergeroniaspis ornata Lerm., B.kutorginorum Lerm.; the brachiopods - Kutorgina sp.

9. Light-brown and light-yellow, thin parting limestones, with interbeds of dolostones of greyish-yellow colour. Sparse occurrence of strongly argillaceous, lumpy limestones 11.8

In the lower part the trilobites - Neopagetina primaeva (Lerm.), Bergeroniellus asiaticus Lerm., B.lermontovae Suv., Bergeroniaspis ornata Lerm., Binodaspis paula Suv.

In the medium part - Bergeroniellus lermontovae Suv., B. asiaticus Lerm., Bergeroniaspis ornata Lerm., Olekmaspis bobrovi Suv., Bathyuriscellus sp.

In the upper part - Pagetia sp., Bergeroniellus lermontovae Suv.

10. Light-brown, thin and medium parting limestones, in the medium part cavernous, lumpy, with uneven bedding surface 10

In the lower part the trilobites - Bergeroniellus lermontovae Suv., B.asiaticus Lerm., Bergeroniaspis ornata Lerm.

In the upper part - Aldonaia ornata Lerm., Bergeroniellus lermontovae Suv., B.flerovae Lerm., Bergeroniaspis ornata Lerm., Binodaspis spinosa Lerm.

11. Argillaceous, light-brown, lumpy limestones with sparse interbeds (0.5 m) of yellowish-grey, thin parting limestones, easily destroying during weathering 9.5

At the levels 1,2,5 and 4.5 above the bottom of the bed there are the trilobites - Bergeroniaspis subornata Lerm., Bergeroniellus lermontovae Suv., B.asiaticus Lerm., Binodaspis paula Suv., Bathyuriscellus sp.

12. Light-brown and brown limestones, thin- and medium parting in the lower and upper parts of the bed and thick parting in the medium part. Lumpy, fine-grained, wavy bedded limestones, interbedding with dolomitic, yellow-grey, shally limestones. Sparse interbeds of organogenous-clastic limestones, sometimes forming lenses 11.6

1 m above the bottom of the bed the trilobites - Neopagetina sp., Bergeroniellus lermontovae Suv., Bathyuriscellus sp.; 4 m - Bergeroniaspis kutorginorum Lerm., B.ornata Lerm.; 5 and 7.5 m - the trilobites - Bergeroniellus lermontovae Suv., Bat-

hyuriscellus sp., Micmaccopsis redlichoides Lerm. and the brachiopods - Kutorgina lenaica Lerm.

Keteme Formation

$\epsilon_1$toy 13. Light-yellow, thin parting dolostones alternate with interbeds (0.3) of massive, cavernous dolostones 2.1

14. Light-yellow, massive, cavernous dolostones 4

15. Light-yellow to white, massive dolostones interbedding with massive, cavernous dolostones 20

16. Yellowish-grey, medium parting dolostones about 7

Section 19

The left bank of the Lena River, 2.5 km above the Elanskoe village (Fig. 10).

The section is the stratotype of the upper boundary of the Lower Cambrian and of the grandis and splendens Zones.

Keteme Formation

thickness(m)

$\epsilon_1$toy^{grn} 1. Grey and blueish-grey, fine-grained, flaggy limestones Apparent thickness 3.5

The trilobites - Lermontovia grandis (Lerm.), Bergeroniellus sp., Paramicmacca sp.; the hyoliths - Sokolovitheca inspersata Sys., Ketemecornus viduus (Sys.), K.ermakovi Sys., K.licitus Sys.

Tit-ary Formation

2. Yellow and light-orange, heterogranular, cavernous dolostones, in some places crystallized 3.8

3. Yellow, heterogranular, massive dolostones 4.3

4. Yellow, medium grained, blocky dolostones and limy dolostones 4.1

5. Feebly argillaceous and argillaceous dolostones. dark-grey and grey at the bottom of the bed and near its top and yellow in the medium part, fine-grained, with sparse admixture of glauconite 1.6

0.2 m above the bottom of the bed there are the trilobites-Paramicmacca peculiaris Jegor.

6. Yellow, heterogranular, massive, feebly cavernous dolostones and limy dolostones 4

7. Yellow, fine-grained, massive dolostones 8

8. Limy, yellow, heterogranular or cryptograined, strongly

fractured dolostones 12

9. Yellow, heterogranular, massive and blocky, in places cavernous dolostones 14

10. Cream-coloured, fine-grained, heteroparting dolostones and argillaceous-limy dolostones with sparse grains of glauconite 2.2

Numerous fragments of trilobites - Paramicmacca sibirica Lerm., P. petropavlovskii Suv., Lermontovia cf. lenaica Suv., Alokistocare sp., A. deflexum Jegor., Granularia sp.

Elanskoe Formation

11. Calcareous-siliceous, grey, glauconitic, massive-flaggy dolostones with interbeds of dolomitic limestones but near the top - dolomitic conglomerate-breccias 3.0-3.5

The brachiopods - Linnarssonia rowelli Pelm., Nisusia kotuyensis Andr., Lingulella ? sp., Obolellidae gen. et sp. indet.

12. White, flaggy limestones containing the algae Amganella sp.; Proaulopora sp. and interbeds of blueish-light-grey limestones 2.3

13. Calcareous, white, "grit", blocky sandstones, at the bottom with lens of dolostones 2.3

Near the bottom there are the trilobites - Paramicmacca sibirica Lerm., P. petropavlovskii Suv., Erbia granulosa Lerm., E. cf. sibirica (Schm.), Chondragraulos minussensis Lerm., C. ex gr. minussensis Lerm., Kooteniella slatkowskii (Schm.), K. acuta N.Tchern., K. turgida Suv., Lermontovia grandis (Lerm.), Granularia obrutchevi Pol., Koptura lata N.Tchern., Alokistocare ? deflexum Jegor., Neopagetina shishkini Jegor., Chondragraulos (Ant.) manca Jegor., Kootenia sp., Prozacanthoides sp., Edelsteinaspis sp.; the archaeocyaths - Erbocyathus heterovallum (Vol.), Irinaecyathus "grandiperforatus" (Vol.), I. schabanovi Roz.; the brachiopods - Linnarssonia sp.

14. Calcareous, organogenous-detritic, white and light-grey, flaggy sandstones 3.5

The trilobites - Paramicmacca petropavlovskii Suv., P. sibirica Lerm., Lermontovia grandis (Lerm.), Edelsteinaspis ornata Lerm., Erbia granulosa Lerm., Neopagetina schishkini Jegor., N. venusta Laz., Namanoia incerta N.Tchern., Chondra-

graulos minussensis Lerm., C. (Ant.) necopina Jegor., Kootenniella slatkowskii (Schm.), K.acuta N.Tchern., Chilometopus convectus Suv., Lenacare asperum Jegor., Binodaspis plana Suv., B.lecta Jegor., Granularia obrutchevi Pol., Laminurus planus Rep., Eoptychoparia sp., Kootenia sp., Koptura sp., Bergeroniellus ? sp.; the archaeocyaths - Tegerocyathus edelsteini (Vol.), T.ketemensis Roz., Archaeocyathus okulitchi (Zhur.), Irinaecyathus "grandiperforatus" (Vol.), I.lenaicus Roz., Kiwicyathus ? egorovae (Roz.); the brachiopods - Linnarssonia rowelli Pelm., Nisusia kotujensis Andr., Trematobolus pristinus bicostatus Gor.

15. White and light-grey, massive sandstones and conglomerate-breccia limestones 8.9

The trilobites - Chondragraulos minussensis Lerm., Kootenniella slatkowskii (Schm.), K.acuta N.Tchern., Edelsteinaspis ornata Lerm., Paramicmacca petropavlovskii Suv., Erbia granulosa Lerm., E.sibirica (Schm.).

Near the bottom of the bed there are the trilobites - Neopagetina schishkini Jegor., N.venusta Laz., Eospencia sp.; the archaeocyaths - Kiwicyathus ? egorovae (Roz.) and the algae - Epiphyton scapulum Korde, Proaulopora glabra Krasnop., Tubophyllum victori Krasnop., Girvanella problematica Nich. et Ether.

In the medium part sparse trilobites - Menneraspis ? sp., Bathyuriscellus sp., Kootenia sp.; the brachiopods - Kutorgina lenaica Lerm., Trematobolus pristinus bicostatus Gor., Nisusia kotujensis And., Lingulella ? sp., Botsfordia caelata (Hall).

Only in the upper half of the bed the following trilobites occur - Namanoia incerta N.Tchern., Alokistocare ? deflexum Jegor., Laminurus planus Rep., Lenacare asperum Jegor., Inouyina lenaica Jegor.

$\epsilon_1$toy^{spl} 16. The lower part of the bed (1.2 m) consists of light-grey, massive limestones with interbeds of organogenous limestones, the medium part (1.2 m) - dolomitic, light-brownish-grey flaggy sandstones;the upper part(0.6 m)-white limestones 3

In massive limestones the following trilobites are recorded - Anabaraspis sp., A.splenders Lerm., A. cf. splendens Lerm., Erbia sibirica (Schm.), E.granulosa Lerm., Alokistocare

laticaudum Reeser, Kootenia ontoensis N.Tchern., K.jakutensis Lerm., K.anabarensis Lerm., Kooteniella slatkowskii (Schm.), Dolichometopus perfidellis Jegor., Edelsteinaspis ornata Lerm., Chondragraulos minussensis Lerm., Eoptychoparia manifesta Laz., Jakutus amplus Jegor., Neopagetina venusta Laz., Perehmania lata N.Tchern., Koptura oblonga N.Tchern., Chilometopus suvorovae Tomashp., Ogygopsis sp., Granularia sp.; the brachiopods - Trematobolus pristinus bicostatus Gor.

Besides, in the upperlying part of the section the trilobites - Edelsteinaspis plana N.Tchern., Koptura lata N.Tchern., Juliaspis solida Sem., Chondragraulos (Ant.) arcuata Jegor., Elankaspis abrosa Jegor., Ogygopsis batis (Walc.), Ptychoparia magna N.Tchern., Chilometopus consuetus Suv., Amgaspis medius N.Tchern., Bathyuriscellus ? sp.; the brachiopods - Linnarssonia rowelli Pelm., Elankella belli (Pelm.), Lingulella ? sp.; the algae - Epiphyton scapulum Korde, Renalcis pectunculus Korde, Proaulopora glabra Krasnop., Subtifloria delicata Masl., Girvanella problematica Nich. et Ether.

17. Dolomitic sandstones (1.5 m), transferring along the line of strike into limestones overlapped by argillaceous-limy, blocky dolostones 3.4

The trilobites - Chondragraulos minussensis Lerm., C.(Ant.) curvae N.Tchern., Kootenia anabarensis Lerm., K.ontoensis N.Tchern., K.amgensis N.Tchern., K.jakutensis Lerm., Kooteniella sima Suv., Olenoides aptus Suv., Amginoerbia selecta N.Tchern., Chilometopus consuetus Suv., Koptura lata N.Tchern., Erbia sibirica (Schm.), E.granulosa Lerm., Chondranomocare sp., Alokistocare sp.; the brachiopods - Linnarssonia rowelli Pelm., Kutorgina lenaica Lerm., Nisusia kotujensis Andr., Elankella belli (Pelm.), Lingulella ? sp., Paterina ? sp.; the algae - Epiphyton scapulum Korde, Girvanella problematica Nich. et Ether.

ϵ_2^{amg} 0.1 m below the top the first Schistocephalus antiquus N.Tchern. occurs.

18. Light-grey, massive and blocky limestones 1.4

The trilobites - Schistocephalus antiquus N.Tchern., Chondragraulos minussensis Lerm., Tankhella devexa N.Tchern., Kootenia ontoensis N.Tchern., Erbia granulosa Lerm., E.sibirica

(Schm.); the brachiopods - Elankella belli (Pelm.), Lingulella ? acuta Pelm., Nisusia kotujensis Andr., Matutella amgensis Andr., Linnarssonia sp., Paterina ? sp., Homotreta gorjanskii (Pelm.), H. salancaniensis (Pelm.).

19. Brownish-grey, flaggy, and thin parting, cliffforming limestones are distinctly tracing in near-by outcrops 0.8

The trilobites - Schistocephalus sp., S. antiquus N. Tchern., Chondragraulos minussensis Lerm., Granularia obrutchevi Pol., Kootenia rasilis Suv., K. deflexa Tomashp., Olenoides aptus Suv., Paradoxides sp., P. rozanovi Jegor.; the brachiopods - Elankella belli (Pelm.), Lingulella ? acuta Pelm., Nisusia kotujensis Andr., Matutella amgensis Andr., Linnarssonia sp., Paterina ? sp., Homotreta gorjanskii (Pelm.), H. salancaniensis (Pelm.).

20. Light-grey and white, massive and flaggy limestones and calcareous sandstones 3.2

The trilobites - Chondragraulos minussensis Lerm., Kootenia amgensis N. Tchern., Neopagetina shishkini Jegor., Elankaspis abrosa Jegor., Granularia sp. and the brachiopods - Nisusia kotujensis Andr., Matutella amgensis Andr. - are typical of the lower half of the bed; and the trilobites - Schistosephalus antiquus N. Tchern., Erbia sibirica (Schm.), E. granulosa Lerm., Kootenia anabarensis Lerm., K. moori Lerm., K. ontoensis N. Tchern., Granularia grandis Lerm., Kooteniella slatkowskii (Schm.), Olenoides cf. calvus Laz.; the brachiopods - Nisusia sp., Matutella amgensis Andr., Elankella belli (Pelm.), Linnarssonia sp., Lingulella ? sp., Obolellidae gen. et sp. indet.; and also the algae - Epiphyton scapulum Korde, Renalcis pectunculus Korde, Botomaella zelenovi Korde, Tubophyllum victori Krasnop. - of the upper half.

21. At the bottom and top of the bed there are interbeds (0.5-0.6 m) of limy, brownish- and dark-grey, jointy dolostones. In the medium part light-grey and white limestones and organogenous limestones with interbeds of calcareous conglomerate-breccias 4.5

The trilobites - Schistocephalus antiquus N. Tchern., Chondragraulos minussensis Lerm., Kootenia amgensis N. Tchern., K. ontoensis N. Tchern., Olenoides aptus Suv., Chondranomocare

ex gr. bidjensis Pol., Amphoton longus N.Tchern., Erbia sibirica (Schm.), Granularia grandis Lerm., Kooteniella slatkowskii (Schm.), Amgaspis medius N.Tchern., Amginouyia elegans N.Tchern.; the brachiopods - Matutella amgensis Andr., Lingulella ? sp.

22. Light-grey and white, flaggy limestones and organogenous limestones, in the medium part with an interbed of calcareous conglomerate-breccias 7.5

The trilobites - Schistocephalus antiquus N.Tchern., Chondranomocare eminens N.Tchern., C.bidjensis Pol., Chondragraulos (Ant.) convexa N.Tchern., C. (Ant.) aff. acutarcuata N.Tchern., C.minussensis Lerm., Amphoton longus N.Tchern., Amgaspis medius N.Tchern., Peronopsis fallax (Linrs.), Kootenia jakutensis Lerm., K.ontoensis N.Tchern., Erbia sibirica (Schm.), Granularia grandis Lerm., G.obrutchevi Pol., Olenoides calvus Laz., Kooteniella slatkowskii (Schm.), Pseudonomocarina aojiformis N.Tchern., Gaphuraspis inornata E.Rom., G.inflata N.Tchern., Elankaspis abrosa Jegor., Lenagraulos stabilis Jegor., Parchmania lata N.Tchern.; the brachiopods - Elankella belli (Pelm.), Nisusia kotujensis Andr.

23. Brownish-grey and white, flaggy and thin parting limestones Apparent thickness 2

The trilobites - Chondragraulos minussensis Lerm., C.(Ant.) ex gr. flerovae Lerm., C. (Ant.) curva N.Tchern., Juliaspis solida Sem., Erbia sibirica (Schm.), Pagetia sp., Kootenia sibirica Lerm., Proasaphiscus sibiricus N.Tchern., Olenoides sp., Amginouyina sp., Tankhella sp., Amphoton sp., Kootenia sp., Kooteniella sp., Chondranomocare sp.

GENERAL CHARACTERISTIC OF LOWER CAMBRIAN STAGES

Tommotian Stage

Tommotian Stage was defined by A.Yu.Rozanov and V.V.Missarzhevsky in 1966 (Rozanov, 1966; Rozanov, Missarzhevsky, 1966). The stratotype of the stage was stated on the Aldan River - "Dvortsy" (Section 1). The hypostratotype of the stage is on the Lena River, the right bank, opposite the Isit' village (Section 3).

The thickness of the stage in the stratotype is 85 m, the

hypostratotype - about 80 m.

The lower boundary of the Tommotian Stage, it is also the lower boundary of the Cambrian, is drawn along the bottom of the Nochoroicyathus (=Aldanocyathus) sunnaginicus Zone. In the section which is given as the type-one, the lower boundary of the stage and the system is drawn along the bottom of bed 8. Unfortunatelly, on the Lena River this part of the section is not exposed in natural outcrops. It can be observed only in boreholes in the Bydyangaya Creek mouth (near Section 3) and near the Kisi-Taas Creek mouth (Zhuravleva et al., 1983).

The upper boundary of the stage is drawn along the bottom of bed 4 in the Section 4 (the Zhurinsky Mys).

The beginning of the Tommotian is characterized by a mass appearance of skeletal fossils.

In the type area in pre-Tommotian deposits there are single tubular forms and acritarchs, abundant microphytolites, stromatolites and "trace fossils". Beginning from the sunnaginicus Zone we find not less than 10 species of archaeocyaths, 8 species of hyoliths, more than 30 species of "phosphatic" problematics and about 15 species of mollusc-like fossils. This assemblage is characterized by the appearance of such widely distributed forms as Turcutheca crassecochlia (Sys.), Exilitheca multa Sys., Ladatheca annae (Sys.), Tiksitheca licis Miss., Hyolithellus tenuis Miss., H.vladimirovae Miss., Coleolus trigonus Sys., Tommotia admiranda (Miss.), T.kozlowskii (Miss.), T.plana (Miss.), Sunnaginia imbricata Miss., Tumulduria incomperta Miss., Camenella garbowskae Miss., Bemella jacutica (Miss.), B.septata (Miss.), Barskovia hemisymmetrica Gol., Aldanella rozanovi Miss. as well as sponges and brachiopods.

On the whole, on the Siberian Platform the assemblage of the sunnaginicus Zone is much richer and can include about 100 species of diverse organisms: archaeocyaths and other sponges, molluscs, brachiopods, diverse groups of problematic fossils (hyolithelmintes, tommotiids, halkieriids and etc.).

About 16 genera of archaeocyaths are described from the Tommotian Stage, most of which are characterized by a simple

porous system of walls and septae. Among them the following genera can be recorded: Archaeolynthus, Dokidocyathus, Rotundocyathus, Nochoroicyathus, Erismacoscinus, Retecoscinus, Okulitchicyathus etc. Only in the second half of the Tommotian Stage the first representatives with tumuli on the outer wall (the Tumuliolynthus, Tumulocyathus genera) appear.

During the Tommotian Age archaeocyaths evolved only by the oligomerization of simple porosity of an outer wall.

Originally, zonal subdivision of the Tommotian deposits was made on archaeocyathan assemblages. Three zones were defined.

The lower, Nochoroicyathus sunnaginicus Zone, was characterized by several species of archaeocyaths: Archaeolynthus polaris (Vol.), Cryptoporocyathus junicanensis Zhur., Dokidocyathus sp., Nochoroicyathus sunnaginicus (Zhur.), N.virgatus (Zhur.), N.belvederi (Roz.), N.vulgaris Zhur., N.tkatschenkoi (Vol.), N.pseudooccultatus Roz., N.aldanicus Zhur., Okulitchicyathus discoformis (Zhur.) and Cambrocyathellus tschuranicus Zhur.

Beginning from the second zone, Dokidocyathus regularis, Dokidocyathus regularis Zhur., Nochoroicyathus anabarensis (Vol.), N.mirabilis Zhur., Retecoscinus sakhaensis A.Zhur., Erismacoscinus rojkovi (Vol.), Cambrocyathellus proximus (Fonin), Dictyocyathus tranlucidus Zhur. and some other forms appear. It is important that in the second half of regularis Zone some forms are added to this assemblage help us to define two subzones (Lapworthella tortuosa and L.bella) within the zone in question not only by tommotiids and other groups but also archaeocyaths. Among them the most interesting are Nochoroicyathus pallidus (Vor.), Sakhacyathus subartus (Zhur.), Tumuliolynthus proximus Zhur. and the first Tumulocyathus kotuyikensis australis (Roz.). Abundant finds of Nochoroicyathus anabarensis (Vol.) are also recorded.

The upper zone, Dokidocyathus lenaicus - Tumuliolynthus primigenius is characterized by an appearance of Dokidocyathus lenaicus Roz., Nochoroicyathus turbidus (Roz.), N.grandis Zhur., Korshunovicyathus melnikovi (Korsh. et Zhur.) and first representatives of the genera Orbicyathus, Sibirecyathus.

The best sections of the sunnaginicus Zone are on the Aldan River and one of them (Section 2) can be considered the type one, the two other zones are better represented on the Lena River in the Section 3 (Isit').

Hyoliths, molluscs and numerous groups of zooproblematics are very diverse in the Tommotian. It is they due to which an additional and, as it, at present, appeared to be, most impressive information concerning the zones and stage is received. It allows us to recognize and correlate Tommotian deposits on all the continents.

The hyoliths of the sunnaginicus Zone are represented by species of the genera Ladatheca, Spinulitheca, Turcutheca, Laratheca, Allatheca and some species of Exilitheca. Tchuranitheca, Antiquatheca, Eonovitatus, Obliquatheca and true hyoliths with ligula Oblisicornus, Notabilitus and others are added to them in the regularis Zone.

Uniformitheca jasmiri (Sys.), Oxytus sagittalis Sys., Doliutus sp.; some species of the genus Burithes and others are typical of the lenaicus-primigenius Zone.

Molluscs are rather abundant from the beginning of the Tommotian. In the sunnaginicus Zone the molluscs Bemella septata (Miss.), B. jacutica (Miss.), B. parula Miss., Aldanella rozanovi Miss. and other are recorded.

In the lower parts of the regularis Zone (subzone tortuosa) Latouchella korobkovi (Vost.), Anabarella indecora Miss., appear. The lenaicus-primigenius Zone is characterized by the finds of Aldanella operosa Miss. By the beginning of the Atdabanian a number of molluscs is sharply reduced within the stratotype area.

A significant component of the Tommotian fauna is Watsonella sibirica (Miss.), recorded in the sunnaginicus and regularis zones.

Anabaritids and other tubular problematics are widely distributed in the Tommotian. Tiksitheca licis Miss., Cambrotubulus decurvatus Miss., Coleoloides trigeminatus Miss., Coleolus trigonus Sys. are especially typical of the lower zone, but anabaritids seldom occur. They are more characteristic of the Lower Tommotian of the Yudoma-Olenek Facies Region.

Some of these fossils are recorded even in older deposits of the Nemakit-Daldyn Horizon (or stage) of the Vendian but mainly outside the stratotype area (north of the Siberian Platform, the Uchur-Maya Area).

Hyolithelmintes, halkieriids and chancelloriids are widely distributed all over Tommotian Stage but their stratigraphic significance is not clear for the present.

Tommotiids (s.l.) are the most significant group for the Tommotian Stage subdivision and correlation. Numerous representatives of the genera Tommotia and Camenella are typical of the whole stage, from its base to the top. They pass to a considerable extent into the Atdabanian Stage.

At the same time genus Lapworthella became the basis for the establishment of the subzones L. tortuosa and L. bella in the regularis Zone. Besides, there are diverse zooproblematics distinctly characterizing separate zones. Of the sunnaginicus Zone typical are Sunnaginia imbricata Miss. and Tumulduria incomperta Miss., for the lenaicus - primigenius Zone - Mobergella radiolata Bengt. The latter form has a very wide geographic distribution. It is a good marker level for correlation of different regions.

Tommotian inarticulate brachiopods are taxonomically poor and represented by the three species: Aldanotreta sunnaginensis Pelm., Cryptotreta neguertchenensis Pelm. (order Paterinida) and Nochoroiella isitica Pelm. (? order Obolellida). The first species is typical of the sunnaginicus Zone. The latter two forms appear in the regularis Zone and then can occur all over the stage and in younger deposits. All three mentioned above species have a simple inner structure of a shell and a position of a pedicle protruding between valves of a shell.

A typical feature of the Tommotian deposits in the stratotype area and other regions is a lack of reliable findings of trilobites in them. Lately, a find of trilobites defined as Termierellinae gen. et sp. indet. 1, T. gen. et sp. 2 (Fedorov et al., 1979) in the sunnaginicus Zone (Section 1) was mentioned. However, after studying this material and many papers of other authors concerning this outcrop, it turned out that fragments of a problematic fossil earlier described by Missarzhevsky as

Tumulduria incomperta Miss. were mistaken for trilobites (Bengtson et al., 1987).

Tommotian calcareous algae are on the initial stage of evolution of this group of flora and that's why they form taxonomically scanty associations. At the base of the Tommotian Stage (sunnaginicus Zone) Renalcis gelatinosus Korde is found that precedes an appearance of an algal stable assemblage: Renalcis gelatinosus Korde, Korilophyton inopinatum Voron., Subtifloria delicata Masl. and Girvanella sp. An assemblage of calcareous algae of the regularis Zone in all regions became diverse and, what is worth recording, for the first time true dendritic forms (Epiphyton) appear.

Some data on acritarchs are of certain interest for the stage itself as well as for correlation with sections of the East-European Platform. Acritarchs are not typical of carbonate facies, in several cases they were found in the sunnaginicus Zone, however, and their composition more like that of the Lontova Horizon (Ogurtsova, 1975). But a compositon of acritarchs from the regularis Zone (Rudavskaya, 1985) is similar to that of the Talsy (=Dominopol') Horizon.

Thus, the three main peculiarities of the stage can be recorded as the most important ones. First, Tommotian archaeocyaths are characterized by simple wall structure, secondly, stage deposits are rich with zooproblematics with phosphatic skeletons and in the third place, trilobites and other arthropods are uncharacteristic of the Tommotian, authentic appearance of which can be recorded only from the beginning of the Atdabanian Stage.

Atdabanian Stage

The Atdabanian Stage subdivided into four zones was established by I.T.Zhuravleva and A.Yu.Rozanov under participation of V.I.Korshunov (Missarzhevsky, Rozanov, 1968; Zhuravleva, Korshunov, Rozanov, 1969).

The stratotype of the Atdabanian Stage in the eastern type of sections includes the upper part of the Pestrotsvet Formation and two lower members of the Perekhod Formation. Unfortunately, the lower part of the stage is not excavated in this area and can be studied only in a borehole in the Gosti-

naya River mouth.

In a transitional type of sections, the Atdabanian Stage includes the upper part of the Pestrotsvet Formation and Nokhoroy Member (Section 4, Zhurinsky Mys - the hypostratotype of the Atdabanian Stage). A rapid development of many groups of fauna which appeared earlier, in the Tommotian (archaeocyaths, hyoliths, brachiopods, some groups of skeletal problematics), is typical of the Atdabanian Stage; some groups, such as trilobites, bradoriids and other arthropods are represented in the Atdabanian for the first time.

The thickness of the Atdabanian in the stratotype area is about 200 m, 8-65 m belong to the upper part of the Pestrotsvet Formation and about 30 m to the first and second members of the Perekhod Formation; the non-exposed part is approximately 100m.

The stratotype of the Atdabanian lower boundary is in the Section 4 (Zhurinsky Mys), it is confined to the boundary between beds 3 and 4. Bed 4 is represented by intercalations of interbeds of algal biostromes (light- and greenish-grey, fine-crystalline limestones) and argillaceous ruddy-red limestones. The stage boundary is drawn in this section at the base of the lower biostrome. It is in rather homogeneous sediments of the Pestrotsvet Formation and has no traces of stratigraphic hiathus.

At the base (beds 4-6 of Section 4) of the Atdabanian Stage there is a representative assemblage of the archaeocyaths: Korshunovicyathus melnikovi (Korsh. et Zhur.), Fransuasaecyathus subtumulatus Zhur., Rotundocyathus ignotus (Korsh. et Roz.), Nochoroicyathus dissepimentalis Zhur., N. grandis Zhur., Retecoscinus zegebarti Korsh. etc.; the trilobites: Profallotaspis sibirica Rep., P. jakutensis Rep.; the crustaceans: Isoxys jurensis Ivantsov; the hyoliths: Obliquatheca bicostata (Miss.), Burithes erum Miss., Conotheca mammilata Miss., Eonovitatus superbus Sys., E. obruptus (Mesh.), Dorsojugatus multicostatus Sys. etc.

Unfortunately, archaeocyaths in bed 3, underlying the Atdabanian Stage in this section, are very sparse. To compare an assemblage of archaeocyaths of the upper Tommotian and those of the lower Atdabanian one need to address the Section

3 (Isit') which facies conditions in an interval corresponding to the upper Tommotian were more favourable for that group.

The Atdabanian upper boundary coincides with the boundary between the second and third members of the Perekhod Formation (beds 20,21 in the Section 8 and beds 23,24 in the Section 9).

Atdabanian trilobites are abundant and diverse, especially in the second half of the stage. Most typical are sutureless trilobites of suborder Olenellinae and small miomeric ones - representatives of family Pagetiidae. A composition of trilobites significantly changes throughout the section what is connected with evolutionary development of the group in the Atdabanian.

Within the stage from base to top four trilobitan zones are successively defined: Profallotaspis jakutensis, Fallotaspis, Pagetiellus anabarus, Judomia (=Uktaspis (Prouktaspis)).

In the lower part of the stage assemblages are low-diverse. Predominated are representatives of family Fallotaspididae. At the base of the stage only one genus Profallotaspis (the jakutensis Zone) is known. The genus is a pandemical for the Siberian Platform, it is the oldest in the Class Trilobita and has several archaic features in its structure. Above, in the Fallotaspis Zone, species of genus Fallotaspis and first species of genus Bigotina belonging to suture trilobites (suborder Redlichiina) are widely distributed, that means a sudden change in trilobite development. Both genera are widely distributed in Lower Cambrian sequences of the globe.

In the second half of the Atdabanian a diversity of trilobites increases. Representatives of the Fallotaspididae family practically do not occur here. They are replaced by those of the Nevadiidae family and diverse Pagetiidae.

Genera Nevadella, Archaeaspis, Pseudoresserops, Triangullina, Compsocephalus and Bigotina not counting a zonal index species are typical of the Pagetiellus anabarus Zone. The composition of the assemblage changes a little inspite of lateral facies substitutions.

In the upper part of the Atdabanian Stage within the stratotype section different assemblages of trilobites are connected with distinct facies. Thus, in the west, where dolostones

are predominant, trilobites of genus Uktaspis (Prouktaspis) and sparse Metadoxides and Bulaiaspis (sections 3-4) occur. Here, the Uktaspis (Prouktaspis) Zone is defined, the stratotype of which is in a section on the right bank of the Lena River, above the Kisi-Taas Creek. In the eastern regions predominant is genus Judomia accompanied by Pagetiellus, Hebediscus, Triangulaspis and in the upper part of the zone - Bonnia, Botomella, Sinskia. They are widely distributed in Cambrian sequences of the globe. Deposits containing these trilobites are joint into the Judomia Zone.

The Atdabanian Stage is a time of an appearance and first stages of development of trilobites. Trilobite carapaces gradually becomes more complicated, their morphological and taxonomic diversity increases, the main features which lately flourished, appear.

For archaeocyaths the Atdabanian is a stage of acme due to a development of compound skeletal elements in morphogenesis. In the Atdabanian forms with aporous septa (Leptosocyathus and others), inner wall with annuli (Taylorcyathus etc.), diverse bracts and channels on an outer wall (Arturocyathus, Carinacyathus etc.) appear.

Beginning from the second half of the stage first families with a complex outer wall occur, such as multiperforate tumuli (Japhanicyathus etc.) or microporous sheaths (Robertocyathus, Mennericyathus). Not only morphological but numerical diversity of Atdabanian archaeocyaths is striking. If in the Tommotian defined are not more than 20 genera then in the Atdabanian a number of archaeocyathan genera exceeds 60, i.e. increased three times as much in the basin restricted in the area (the stratotype area of the Lower Cambrian).

But together with representatives of new genera, families and higher taxa there are a great number of forms "traced" from below. These are the genera: Archaeolynthus, Tumuliolynthus, Nochoroicyathus etc.

According to archaeocyaths the Atdabanian Stage can be subdivided into 4 zones, non-identical to trilobite zones (from base to top): Retecoscinus zegebarti, Carinacyathus (=Porocyathus) pinus, Nochoroicyathus kokoulini and Fansycyat-

hus lermontovae. A large buildup located in the Anabar-Sinsk Facies Region, and built by algae or algae together with archaeocyaths controlled a lateral distribution of archaeocyaths. As a result, archaeocyathan assemblages of all the four zones do not always have the same characteristic all over the whole region.

In the Retecoscinus zegebarti Zone in the west (sections 3-4) among archaeocyaths "tracing" forms are predominate and only several forms with complex walls show a renewal of composition compared with the Tommotian Stage but in the east forms with a complex inner wall were already abundant: Leptosocyathus polyseptus (Latin), Heckericyathus heckeri (Zhur.) etc. The lower boundary of the zone coincides with that of the stage and its stratotype is a section of the Zhurinsky Mys.

The Carinacyathus pinus Zone and two upper zones (Nochoroicyathus kokoulini, Fansycyathus lermontovae) are common by their characteristic for the whole type area. Archaeocyaths are almost completely absent to the west from the Section 3. Most distinct zonal assemblages of the Atdabanian Stage (except the lower-most zone) are visible in the Oymuran village area.

The pinus Zone is represented here by archaeocyaths of the families Carinacyathidae, Lenocyathidae, Geocyathidae etc. Typical are the genera Geocyathus, Dokidocyathella, Plicocyathus etc., as a rule, with complex walls. The upper boundary of the zone occurs at a boundary between beds 7 and 8 of the Section 8.

Except a zonal index species, Degeletticyathus galuschkoi (Zhur.), Taylorcyathus subtaylori Zhur., Ringifungia vavilovi Korsh., Gordonicyathus apprimus (Korsh.) etc. are typical of the Nochoroicyathus kokoulini Zone. The upper boundary of the zone in the stratotype (section Oymuran) is drawn in bed 8 (in the interval 36-40 m from the base of the bed). Finally, the Fansycyathus lermontovae Zone is characterized by such forms as Propriolynthus vologdini (Jak.), Batschykicyathus angulosus A.Zhur., Robertocyathus meshkovae Zhur., Fallocyathus dubius Roz., Japhanicyathus genurosus Korsh., Mennericyathus gratus (Korsh.) etc.

The upper boundary of the zone in the stratotype of the stage coincides with the upper one of the stage.

In the end it should be said that Atdabanian archaeocyathan assemblages are the most abundant and variable in the type-sections of Lower Cambrian of the Siberian Platform. It is one of the most important stages of archaeocyathan evolution. At this level for the first time it is possible to make a global correlation by this group.

Trilobite and archaeocyathan zonal boundaries are not always coincide, namely: on trilobites only in the second half of the Atdabanian Stage two different lateral assemblages are discovered (the Uktaspis (Prouktaspis) - Judomia Zone), but on archaeocyaths such lateral assemblages are registered for the first level from the base (the zegebarti-polyseptus Zone).

The Atdabanian age is a time of further development of hyoliths. Typical is a substantial renewal of hyolithan assemblages. By the beginning of the Atdabanian many forms from the orders Circothecida, Orthothecida, typical of the Tommotian, significantly reduced. Simultaneously, during this epoch a variety of order Hyolithida increased.

Inarticulate brachiopods are represented by four species in the Atdabanian: Cryptotreta neguertchenensis Pelm., Nochoroiella isitica Pelm., Obolella chromatica Bill. and Sibiria magna Gor. In the middle part of the stage the oldest articulate brachiopod (Nisusia ? sp.) (Ushatinskaya, 1986) occurs.

For problematical skeletal organisms and molluscs the Atdabanian Stage is a time of further development of morphologically diverse forms. Together with groups widely distributed in the Tommotian (hyolithelmintes), at this level a large number of fossils occur, earlier unknown. Some Atdabanian small shelly fossils are recorded in many regions of the world (genera Rhombocorniculum, Mobergella, Microdictyon, Hadimopanella, Pelagiella etc.). In type-sections of the Siberian Platform in the lower half of the Atdabanian Stage there is a quantitative reduction of problematic organisms and molluscs at generic and also species levels. In the upper part of the lermontovae Zone their variability is, however, increasing again. In this zone in the stratotype area first finds of cribricyaths occur (Sundukov, Zhuravlev, 1989). Bradoriids (class Crustacea) recorded in Atdabanian deposits can be referred to two genera: Bradoria

(family Bradoriidae) and Cambria (family Beyrichonidae).

A composition of Atdabanian calcareous algae is characterized by sharp difference as compared with the Tommotian, only. Species composition is fully renewed, a number of new genera appear. In the Atdabanian a number of species is insignificant. The complex comprises Renalcis gelatinosus Korde, R.pectunculus Korde, R.levis Vol., Epiphyton scapulum Korde, E.durum Korde, Proaulopora glabra Krasnop., Batenevia ramosa Korde, Subtifloria delicata Masl., Girvanella problematica Nich. et Ether., Obruchevella delicata Reitl. All the forms, excepting Obruchevella delicata Reitl., and Renalcis levis Vol., are extremely numerous and for the first time in the record of their development reach wide distribution.

Thus, the Atdabanian Stage is characterized by the following peculiarities: a) an appearance of complex skeletal elements in the evolution of regular archaeocyaths (bracts, microporous sheaths, multiperforate tumuli and etc. - on an outer wall; scales, annuli, canals on an inner wall; aporous septa; b) an appearance of the first representative assemblage of trilobites, among which sutureless forms are predominant, and other arthropods (bradoriids, phyllocarids); c) substantial changes in composition of other organisms: an appearance of echinoderms, articulate brachiopods, stenothecoids, cribricyaths, hydroconozoans, tommotiids with septa in shell (Lugoviella) as well as some forms of phosphatic zooproblematics, unknown in Tommotian sediments (Hadimopanella, Microdictyon etc.).

Botomian Stage

Botomian stage was defined in 1964 by I.T.Zhuravleva, L.N. Repina, V.V.Khomentovsky and A.Yu.Rozanov (Repina et al.,1964). When substantiating a stage definition the authors showed that trilobite and archaeocyathan assembalages in the lower and upper half of the Lenian Stage accepted in the Unified Scheme (1956) differed. These differences cannot be explained by facies reasons, as monofacies sections of this interval (Kharaulakh, the Tuora-Sis Ridge) are known where fossil assemblages change very sharply in monofacies sediments. The lower, newly accepted stage, was called Botomian.

When defining the Botomian Stage its stratotype was shown

on the Botoma River in an area of abundant meanders (Repina et al., 1964). The best section in this area is on the Botoma River left bank, 5.5 km below the Kyyry-Taas Creek mouth. The stage hypostratotype is defined along the Lena River right bank, from the Achchagyy-Kyyry-Taas Creek (Section 8) to Labaya Creek (Section 12). The stage includes two upper members of the Perekhod Formation (III and IV), the Sinsk and Kutorgina Formations, with the total thickness about 300 m.

The stage lower boundary stratotype is drawn along the base of the third unit of the Perekhod Formation, in the type section of the stage situated along the Botoma River. The lower boundary hypostratotype is in the Section 9(the Lena River right bank, 1.5 km below the Ulakhan-Kyyry-Taas Creek) at the base of the third unit of the Perekhod Formation (the bottom of bed 24). In the mentioned sections, as well as in others, where this interval is exposed above the boundary there is a substantial renewal in trilobite assemblages. The following genera appear: Neocobboldia, Erbiella, Bergeroniellus, Bergeroniaspis, Micmaccopsis etc. It should be stressed that typical representatives of family Protolenidae appear here. A renewal in trilobite assemblages at this level is not connected with any lithological changes happened there. Some genera typical of the Atdabanian Stage (Triangulaspis, Judomia, Sinskia etc.) pass into the Botomian, but occur here only sporadically. An increase in diversity in a trilobite assemblage of the Botomian Stage are gradual. In the third unit archaeocyaths are sparse.

The stage upper boundary is drawn along the base of the Ketema Formation containing a small amount of fossils in the lower part. The stratotype of the upper boundary is in a section on the Lena River left bank, 1 km below the Tit-Ary village.

Botomian fossils are represented by trilobites, archaeocyaths, brachiopods, sparse molluscs and problematics, hyoliths and calcareous algae, and representatives of Burgess Shale-type fauna.

Trilobites are abundant and diverse, especially in the stage lower part. Representatives of family Protolenidae and mainly the genera Bergeroniellus and Bergeroniaspis are most

typical of the stage. Excepting these genera, almost all over the stage section there are the genera: Bathyuriscellus, Micmaccopsis, Aldonaia, Binodaspis, Kootenia, Pagetiellus, Bonnia etc. The latter two genera pass from the Atdabanian to Botomian Stage. Besides, at the base of the Botomian Stage there are genera which acme in the Atdabanian. These are: Judomia, Sinskia, Hebediscus, Triangulaspis. A composition of trilobite assemblages greatly changes throughout the stage section what allows us to define several biostratigraphic zones (upwards) within its limits: Bergeroniellus micmacciformis - Erbiella (=Laticephalus - Erbiella), Bergeroniellus gurarii, B. asiaticus, Bergeroniaspis ornata.

The stratotype of the lower zone of the stage (micmacciformis-Erbiella) is in the Section 9 (beds 24-46). A trilobite assemblage of this zone is extremely diverse and has about 35 genera. The following genera predominate: Erbiella, Judomiella, Neocobboldia, Micmacopsis, Kootenia, Atdabanella, Bergeroniellus. Finds of sparse genera are typical of this part of the stage: Lenadiscus, Tungusella, Chondrinouyina, Tarynaspis, Validaspis, Redlichina etc.

In the western parts of the stratotype area (the Oymuran section) a composition of the assemblage of the lower Botomian substantially differs from the mentioned above what is connected with a change in sedimentary and environmental conditions.

Here, the Laticephalus-Erbiella Zone is distinguished which stratotype is in the Oymuran section. Genera of superfamily Corynexochoidea (Poliellina, Bonnia, Bonnaspis etc.) predominate in the zone. Typical are also genera: Laticephalus, Erbiella, Rondocephalus, Erbiopsis, Kadyella etc., which are usual for the Sanashtykgol Horizon of the Altay-Sayan Fold Belt.

In the upper half of the Botomian a trilobite diversity is greatly reduced. Here, the genera dominate: Bergeroniellus, Bergeroniaspis, Neopagetina, Pagetiellus, Aldonaia, Bonnia, Kootenia, Proerbia, Granularia, Bathyuriscellus etc. are also usual. Assemblages of all the three upper zones differ mainly in species composition of the genera Bergeroniellus and Bergeroniaspis.

The stratotype of the gurarii Zone is on the right bank of the Sinyaya River, 6 km above the mouth. The zone, except an index species, is characterized by Bergeroniellus spinosus Lerm., Bergeroniaspis lenaica Laz., Pagetiellus lenaicus (Toll).

The stratotype of the asiaticus Zone is in the same section. The zone is characterized by the species: Bergeroniellus asiaticus Lerm., B. expansus (Lerm.), B. praeexpansus Suv., Bergeroniaspis divergens Lerm., Neopagetina primaeva (Lerm.), Kootenia jakutensis Lerm., Binodaspis prima Lerm., Bathyuriscellus parvus Suv.

The stratotype of the ornata Zone is on the Lena River right bank, 4 km below the Labaya Creek (Section 12, beds 8-12). Bergeroniaspis ornata Lerm., Bergeroniellus lermontovae Suv., B. flerovae Lerm., Solenopleurella bella (Rjons.), Olekmaspis bobrovi Suv. etc. are common for the zone. An overwhelming majority of the Botomian trilobite genera are widely distributed in Siberian sections and many of them behind the limits of the region. At the same time such genera as Atdabanella, Sinijanella, Zacantella, Muchattellina are known only from the type stage sections. The Botomian Stage has a similar characteristic on trilobites in all the sections of the Anabar-Sinsk Facies Region. In the Turukhansk-Irkutsk-Olekma Facies Region genera Bathyuriscellus and Jakutus have a special distribution. Genus Tungusella predominates at the base and Olekmaspis in the upper part. In the Yudoma-Olenek Facies Region sediments of the Botomian Stage has, as a rule, an insignificant thickness. In the lower part of the stage miomeric trilobites Calodiscus, Pagetiellus are usual, in the upper one - genus Bergeroniellus.

The Botomian Stage is an optimal stage in a development of archaeocyaths. Their assemblages consist of many species and from morphological and systematical viewpoint are most abundant and diverse.

On the Siberian Platform, archaeocyathan assemblages do not, however, reveal the evolutionary pattern of this group during the Botomian Stage. It can be explained by unfavourable facies developped in an Early Cambrian basin in the given territory. In the Lower Cambrian stratotype region a rather complete comp-

lex of archaeocyaths is known for the lowest subdivision of the Botomian Stage in the Carinacyathus (=Porocyathus) squamosus-Botomocyathus zelenovi Zone which approximately corresponds to the micmacciformis-Erbiella Zone. The stratotype of the zone is in a section along the Lena River right bank, 1.5 km below the Ulakhan-Kyyry-Taas Creek (Section 9, beds 24-26). This subdivision includes the third and fourth members of the Perekhod Formation. Archaeocyaths are known from both units but only in the upper one the assemblage is rather representative. Here, excepting C.squamosus, usually present are Trininaecyathus, Rozanovicyathidae etc. Most typical archaeocyathan assemblage of this zone is in a region of development of the Oymuran Massif where Tumuliolynthus karakolensis Zhur., Rhabdolynthus conicus Zhur., Rossocyathella ninaekosti Zhur., Ladaecyathus sublimbatus Zhur., Botomocyathus zelenovi Zhur., Muchattocyathus sibiricus Roz. etc. occur. This assemblage is characterized by forms with very complex walls (for example, latticed, as at Botomocyathus) and by an elaborated structure of an intervallum (Muchattocyathus).

Archaeocyaths are sparse in the third member of the Perekhod Formation, because it is mainly consists of strongly argillaceous limestones of which archaeocyaths are not typical. That's why the Botomian lower boundary was arguable for a long time (Khomentovsky, Repina, 1965; Zhuravleva, Korshunov, 1965; Zhuravleva, Korshunov, Rozanov, 1969; Zhuravleva, Meshkova, Luchinina, 1969; Zhuravleva, 1979; Zhuravlev, 1981; Astashkin et al., 1981).

In the upper part of the Botomian Stage archaeocyaths are not recorded neither in the stratotype nor hypostratotype section but there are some localities in neighbouring sections. Of younger age are, probably, archaeocyaths from lenses of limestones in the upper part of the Mukhatta Formation (the Mukhatta River, 50 km above the Kyyry-Taas Creek; the Achchagyy-Taryng Creek, 15 km from the mouth; 4.5 km above the Ulakhan-Taryng Creek). It should be noted that a tracing of this level in the type section of the Botomian Stage is argumentative. Some scientists correlate it with the fourth member of the Perekhod Formation (Khomentovsky, Repina, 1965), others-

with the Sinsk one (Zhuravleva, Korshunov, Rozanov, 1969; Sundukov, 1986). The following archaeocyaths are typical of this level: Sibirecyathus polysynapticulosus (Korsh.), Rossocyathella shenfili Zhur., Botomocyathus astrumus Korsh., Ladaecyathus sublimbatus Zhur., Rozanovicyathus alexi Korsh., Mennericyathus grigorievi (Zhur.), Coscinocyathus latus Korsh. etc.

Separate lenses with archaeocyaths are recorded at the level of the ornata Zone (the Sinyaya River, 60 km above the mouth). There are "Adaecyathus solidus" (Vol.), "Adaecyathus" ? sp. here. That assemblage has been before mistakenly attributed to the lower part of the Keteme Horizon (Zhuravleva, 1960).

Brachiopods of the Botomian Stage are rather diverse. Most typical are genera Botsfordia, Linnarssonia, Palaeoschmidtites which are rather abundant in its middle part. A species composition of Botomian brachiopods distinctly differs from the Atdabanian and is represented by 8 species. Species Sibiria magna Gor. passes from the underlying deposits to the micmacciformis-Erbiella Zone. Besides, Palaeoschmidtites siniellus (Pelm.), Botsfordia caelata (Hall) also occur in this zone. The latter two species continue to exist in zones gurarii and asiaticus with Linnarssonia rowelli Pelm. In the ornata Zone species Kutorgina lenaica Lerm. is recorded. The upper part of the Botomian Stage is poorly characterized.

Botomian hyoliths are rather diverse and abundant, especially in its lower part (the micmacciformis-Erbiella Zone). Above the mentioned level species diversity of hyoliths is sharply reduced. Together with transitional forms (15 species) in the Botomian a substantial renewal of a hyolithan assemblage takes place. Newly appeared species are: Novitatus tarynicus Sys., N. lermontovae Sys., Sokolovitheca sokolovi Sys., Holmitheca obvia Sys. etc. (14 species).

In the micmacciformis-Erbiella Zone in the type sections 16 species of hyoliths are recorded.

Species Holmitheca obvia Sys., H. zhuravlevae Sys., Sokolovitheca sokolovi Sys., Erraticornus debilis Sys., Nitorcornus pictus Sys., N. vegetus Sys., N. subtilis Sys. are typical of the gurarii Zone.

In the asiaticus Zone hyoliths are extremely sparse. Here, only Erraticornus kordeae Sys., Insignicornus rectus Sys., Obliquatheca pulchella Val. are found.

Molluscs known from the Botomian in the type sections are represented by 3 species: Ilsanella atdabanica (Miss.), Yochelcionella stylifera Miss. and Pelagiella lorenzi (Cobb.). These species occur only in the micmacciformis-Erbiella Zone.

A Botomian assemblage of skeletal problematics in the type sections is not representative and, what's more, most forms are transitional from the Atdabanian Stage. In the micmacciformis-Erbiella Zone, Rhombocorniculum cancellatum (Cobb.), Hadimopanella knappologica (Bengt.), Lapworthella dentata Miss. and Lugoviella ojmuranica Grig. are recorded.

In the gurarii Zone, Microdictyon sp. and Rhombocorniculum cancellatum (Cobb.) are found.

Botomian assemblages of calcareous algae do not sharply differ from the Atdabanian ones. They lack earlier known abundant species of genera Renalcis and Epiphyton what is, probably, connected with facies peculiarities. Genera and species of Botomian stage are not new, they were known before. They are represented by the typical forms: Proaulopora glabra Krasnop., Batenevia ramosa Korde, Subtifloria delicata Masl. and Girvanella problematica Nich. et Ether. Most of these algae do not stop its existense in the Botomian. Flora of the Botomian, inspite of its poor taxonomic composition, creates abundant biostromes.

Botomian stage in its stratotype section, thus, has a rich palaeontological characteristic what makes it possible to trace it easily in Siberian sections as well as in Lower Cambrian sections of other regions. The stage, on the whole, is characterized by an acme of trilobites, archaeocyaths and other Early Cambrian organisms and their wide geographic distribution. Among trilobites especially abundant are suture forms and among them protolenids predominated. Archaeocyaths reach maximum morphologic diversity, especially forms with complex walls are developed. Among them there are forms with clathrate and double outer walls and porous canals in inner walls. The appearance of facies containing Burgess Shale-type fossils is also

a characteristic feature of the Botomian Stage.

Toyonian Stage

For the first time a name "Toyonian" was proposed by the authors when Cambrian regional stratigraphic schemes of Middle Siberia were discussed at the 1982 (May) Plenum of the U.S.S.R. Interdepartmental Stratigraphic Committee where it was registered as the upper subdivision of lower series of the Cambrian System for the territory of the U.S.S.R. "Toyonian" is named after the Toyon-Ary Island near the Elanskoye village. A volume of the Toyonian Stage is equal to that of Lenian one established by L.N.Repina, V.V.Khomentovsky, I.T.Zhuravleva and A.Yu.Rozanov (Repina et al., 1964) and Elankian one of A.Yu.Rozanov (1973).

A type area for the stage definition is the Middle Lena River, the left bank, between the Tit-Ary and Elanskoe villages. The stage was studied on several cliffs to 100 m in height and several kilometres in length outcropped along the bank line. The stage consists of the Keteme (the thickness about 150 m), Tit-ary (the thickness about 55 m) and Elanskoe (the lower 27 m) formations. The total thickness of the Toyonian Stage is 230-235 m.

The lower stage boundary (its stratotype is in the section 1 km downstream the Tit-Ary village) is drawn along the Keteme Formation base, though the first trilobites (Bergeroniellus ketemensis Suv.) typical of this subdivision appear 6 m above the formation base. The boundary is conventional to some extent due to a lack of fauna in the oldest beds of the Toyonian Stage. But a gradual change in a type of sedimentation at this boundary (a pass from the Kutorgina to Keteme Formation) rules out a sharp renewal of faunal assemblages. A close relation between the Botomian and Toyonian stages is proved by numerous finds of the transitional trilobite genera: Aldonaia, Pagetiellus, Edelsteinaspis, Binodaspis etc. It should be stressed that a palaeontological characteristic of the Toyonian Stage is extremely peculiar and that's why easily recognized in other sections. All the data obtained permit us to regard the Toyonian lower boundary as the beginning of the final stage in evolutionary development of different taxa of Early Cambrian faunas.

The Toyonian upper boundary (its stratotype is 2.5 above

the Elanskoe village, Section 19) is drawn inside the Elanskoe Formation at 27 m from the base by the occurrence of the first trilobites of genus Schistocephalus.

In 1972 at the All-Union Meeting on trilobites (Decisions..., 1973) V.E.Savitsky and Yu.Ya.Shabanov suggested to begin the Middle Cambrian from the base of the Anabaraspis Zone. At the same meeting the stratotype of that boundary was chooseń in the Nekekit River section (Egorova et al., 1976). The latest material on this problem published in 1983 was based on a study carried out by deep hydrogeological boreholes drilled in the Daldyn-Alakit Area (Shabanov et al., 1983). N.P.Suvorova (1964, 1980 etc.) believes that the whole Elankian Horizon (i.e. including the grandis Zone) should be attrubuted to the Middle Cambrian.

In the Toyonian the most numerous, among fossils, are trilobites, in the upper half-sparse archaeocyaths, brachiopods, stenothecoids, calcareous algae and only in one locality hyoliths are found.

In quantitative respect fragments of trilobite carapaces are unevenly distributed in the Toyonian Stage. The upper part of the stage is especially rich in them but the Titary Formation is almost lacking in fauna.

All genera of Toyonian trilobites due to its occurrence to different stratigraphic levels can be divided into several groups:

I. Trilobites connecting the Botomian and Toyonian stages occurring only in the lower half of the latter - Pagetiellus, Bonnia, Micmaccopsis, Aldonaia, Redlichina, Hebediscus, Neocobboldia, Botomella.

II. Trilobites passing from the underlying Botomian Stage and to the top of the Toyonian - Bergeroniellus, Neopagetina, Edelsteinaspis, Kootenia, Granularia. The latter two genera pass even into the lower Middle Cambrian.

III. Trilobites appearing and becoming extinct during the Toyonian - Lermontovia, Paramicmacca, Anabaraspis, Namanoia, Koptura, Prozacantoides, Eoptychoparia etc.

IV. Trilobites appearing at the end of the Toyonian (from the time of deposition of the lower Elanskoe Formation) and

passing into the Middle Cambrian - Chondragraolus, Dolichometopus, Ogygopsis, Amgaspis, Kooteniella, Chilometopus, Erbia etc.

Basing upon trilobite distribution, in the Toyonian Stage three zones are defined (upwards):

In the stratotype the Bergeroniellus ketemensis Zone occupies the lower one third of the Keteme Formation, its thickness is about 56 m. Here, mainly limestones of light colour, interbedding with greyish-brown dolostones are developed.

The zone in question is, undoubtedly, poorer in quantitative and qualitative composition than the upper beds of the underlying stage. The newly appeared species are the following- Bergeroniellus ketemensis Suv., Neopagetina primaeva (Lerm.), N.glabra Lerm. The rest species are transitional from below: Bergeroniellus lermontovae Suv., B.asiaticus Lerm., B.solitarius Suv., Pagetiellus lenaicus (Toll), Binodaspis paula Suv., Redlichina sp., Micmaccopsis sp., Bergeroniaspis ornata Suv. etc. In the uppermost beds of the zone - Binodaspis secunda Suv., Proerbia prisca Lerm., Edelsteinaspis gracilis Lerm. etc.

In the stratotype the Lermontovia grandis Zone includes the other part of the Keteme Formation, the Titary Formation from top to bottom, and the lower 20 m of the Elanskoe Formation, the total thickness 170 m. The deposits building the zone are diverse: limestones and dolostones, calcareous sandstones and conglomerate-breccias. The species of the genera Lermontovia and Paramicmacca: L. grandis (Lerm.), L.dzevanovskii(Lerm.), L.lenaica Suv., P.sibirica Lerm., P.peculiaris Jegor., P.petropavlovskii Suv. are dispersed almost from the bottom to the top of the zone. On the whole, fossils are unevenly distributed: rather sparse in the lower half (the Keteme Formation), almost lack in the part comprised by dolostones of the Titary Formation and very abundant and diverse in clastic rocks of the Elanskoe Formation. In the lower half there are the trilobites: Neocobboldia dentata (Lerm.), Neopagetina primaeva (Lerm.), Binodaspis stabilis Jegor., Proerbia priska Lerm., Edelsteinaspis ornata Lerm., Bergeroniellus lermontovae Suv., B.asiaticus Lerm., B.solitarius Suv., Aldonaia ornata Lerm., Solenopleurella bella (Rjonsn.), Bergeroniaspis kutorginorum

Lerm., B.ornata Lerm., Redlichia integella Jegor., sparse Bergeroniellus ketemensis Suv.; the brachiopods - Kutorgina lenaica Lerm.; the hyoliths - Sokolovitheca insperata Sys., Ketemecornus viduus (Sys.), K.ermakovi Sys., K.lecitus Sys.

In the upper 20-22 metres of the zone the composition of a fauna is the following: the trilobites - Granularia obrutchevi Pol., Kooteniella slatkowskii (Schm.), K.acuta N.Tchern., Alokistocare? deflexum Jegor., Kootenia magna Lerm., Erbia granulosa Lerm., E.sibirica (Schm.), Koptura lata N.Tchern., Chondragraulos minussensis Lerm., Edelsteinaspis ornata Lerm., Laminurus planus Rep., Lenacare asperum Jegor., Neopagetina shishkini Jegor., Binodaspis plana Suv., B.lecta Jegor., Chilometopus consuetus Suv. etc.; the archaeocyaths - Irinaecyathus lenaicus Roz., I.schabanovi Roz., Kiwicyathus ? egorovae (Roz.), Erbocyathus heterovallum (Vol.), Tegerocyathus edelsteini (Vol.), T.ketemensis Roz., Archaeocyathus okulitchi (Zhur.) etc. and the brachiopods - Linnarssonia rowelli Pelm., Homotreta gorjanskii (Pelm.), Botsfordia caelata (Hall), Trematobolus pristinus bicostatus Gor., Kutorgina lenaica Lerm., Nisusia kotujensis Andr.; the calcareous algae - Epiphyton scapulum Korde, Proaulopora glabra Krasnop., Tubophyllum victori Krasnop., Girvanella problematica Nich. et Ether.

In the stratotype area a section of the lower series of the Cambrian System is capped by the Anabaraspis splendens Zone with the thickness about 6.5 m. The top of the splendens Zone in the Section 19 is the boundary stratotype between the Lower and Middle Cambrian. The trilobites are typical of this zone - Anabaraspis splendens Lerm., Alokistocare laticaudum Resser., Kootenia ontoensis N.Tchern., K.jakutensis Lerm., K.anabarensis Lerm., Jakutus amplus Jegor., Eoptychoparia manifesta Laz., Parehmania lata N.Tchern., Koptura oblonga N.Tchern., Edelsteinaspis ornata Lerm., E.plana Lerm., Ogygopsis sp. and the brachiopods - Linnarssonia rowelli Pelm., Elankella belli (Pelm.); the calcareous algae - Epiphyton scapulum Korde, Renalcis pectunculus Korde, Proaulopora glabra Krasnop., Subtifloria delicata Masl., Girvanella problematica Nich, et Ether.

The Toyonian Stage is the fourth (the last) stage of archaeocyathan evolution. Nevertheless, their abundance and peculia-

rity of species composition are the feature due to which this stratigraphic level is unmistakably recognizable even in sections far from Siberia. In the stratotype area, archaeocyaths are abundant in the middle part of the Toyonian Stage, only.

Brachiopods are represented by 8 species in the Toyonian stratotype section: Linnarssonia rowelli Pelm., Homotreta gorjanskii (Pelm.), Botsfordia caelata (Hall), Elankella belli (Pelm.) (order Acrotretida), Trematobolus pristinus bicostatus Gor. (order Obolellida), Kutorgina lenaica Lerm., Nisusia kotujensis Andr. and Matutella amgensis Andr. (order Orthida). A peculiarity of this time is an acme of Trematobolus and appearance of the abundunt articulate brachiopods - Nisusia and Matutella, as well as lingulids and acrotretids passing from the underlying deposits. It should be noted that Trematobolus and Kutorgina are not found above the roof of the Toyonian Stage.

Cambridium nikiforovae Horny (stenothecoids) is known from "small" shelly fossils.

Practically, all the finds of the mentioned above fossils occur in the upper part of the stage.

Calcareous algae of the Toyonian Stage build small archaeocyathan-algal bioherms, found among clastic rocks of the Elanskoe Formation (Section 19). They are represented by Renalcis pectunculus Korde, Epiphyton scapulum Korde; in an enclosing rock recorded are Proaulopora glabra Krasnop., Subtifloria delicata Masl. and Girvanella. The composition and number of algae was much poorer compared with older assemblages of the Lower Cambrian. There is no sharp differences between calcareous algae of the Toyonian Stage and those of the Middle Cambrian.

A detailed biostratigraphy of the upper parts of the section in the stratotype area (Toyonian Stage), its comparison with sections of the neighbouring regions, a correlation with similar and sharply different facies of this stratigraphic level - all these questions are rather clearly interpreted in published literature (Pokrovskaya, 1954, 1961; Suvorova, 1954, 1956, 1960, 1964; ISC Decisions..., 1959, 1963; Zhuravleva et al., 1964; Khomentovsky, Repina, 1965; Savitsky et al., 1972; Rozanov, 1970, 1973; Repina, 1974; Egorova et al., 1976 et al.).

The most complete report including all the present material on stratigraphy and correlation of Lower Cambrian deposits is the Unified Stratigraphic Scheme confirmed by the U.S.S.R. International Stratigraphic Committee in May, 1982 (Resolutions..., 1983). A comparative characteristic of faunal assemblages of the Toyonian Stage of the stratotype area (the Anabar-Sinsk Facies Region) with sections in other regions (Turukhansk-Irkutsk-Olekma and Yudoma-Olenek) is thoroughly studied in papers by L.N.Repina (1974) and L.I.Egorova et al. (1976).

The distinctive features of the Toyonian Stage run as follows: first - the trilobites Lermontovia and Paramicmacca exist only in it, secondly - the first Paradoxididae, genus Anabaraspis, appear in its upper beds and thirdly - the Toyonian is the last stage of a wide distribution of archaeocyaths.

(ARKHANGEL'SKAYA N.A., GRIGOR'EV V.N., ZELENOV K.K.)
АРХАНГЕЛЬСКАЯ Н.А., ГРИГОРЬЕВ В.Н., ЗЕЛЕНОВ К.К. Фации нижнекембрийских отложений южной и западной окраин Сибирской платформы. М.: Изд-во АН СССР, 1960. 190 с. (Труды ГИН АН СССР; Вып. 33).

(ASTASHKIN V.A.) АСТАШКИН В.А. Основные типы органогенных построек в рифовых системах кембрия северного склона Алданского щита // Геология рифовых систем кембрия Западной Якутии. Новосибирск, 1979. С. 19-30. (Труды СНИИГГиМС; Вып. 270).

(ASTASHKIN V.A., VARLAMOV A.I., EGOROVA L.I., SHABANOV YU.YA.)
АСТАШКИН В.А., ВАРЛАМОВ А.И., ЕГОРОВА Л.И., ШАБАНОВ Ю.Я. Стратиграфическое положение трилобитов "санаштыкгольского" комплекса в стратотипическом разрезе нижнего кембрия р.Лены // Стратиграфия и палеонтология Сибири. Новосибирск, 1981. С. 5-15. (Труды СНИИГГиМС; Вып. 287).

(ASTASHKIN V.A., VARLAMOV A.I., GUBINA N.K., EKHANIN A.E., PERELADOV B.S., ROMENKO V.I., SUKHOV S.S., UMPEROVICH N.V., FEDOROV A.B., FEDYANIN A.P., SHISHKIN B.B., KHOBNYA E.I.)
АСТАШКИН В.А., ВАРЛАМОВ А.И., ГУБИНА Н.К., ЕХАНИН А.Е., ПЕРЕЛАДОВ В.С., РОМЕНКО В.И., СУХОВ С.С., УМПЕРОВИЧ Н.В., ФЕДОРОВ А.Б., ФЕДЯНИН А.П., ШИШКИН Б.Б., ХОБНЯ Е.И. Геология и перспективы нефтегазоносности рифовых систем кембрия Сибирской платформы. М.: Недра, 1984. 181 с.

(BARSKOV I.S., ZHURAVLEV A.YU.) БАРСКОВ И.С., ЖУРАВЛЕВ А.Ю. Мягкотелые организмы кембрия Сибирской платформы // Палеонт. журн. 1988. № 1. С. 3-9.

BENGTSON S., FEDOROV A.B., MISSARZHEVSKY V.V., ROZANOV A.YU., ZHEGALLO E.A., ZHURAVLEV A.YU. Tumulduria incomperta and the case for Tommotian trilobites // Lethaia. 1987. Vol. 20. N 4. P. 361-370.

BENGTSON S., MATTHEWS S.C., MISSARZHEVSKY V.V. The Cambrian netlike fossil Microdictyon // Problematic Fossil Taxa / A.Hoffman and M.H.Nitecki, eds. N.-Y.: Oxford University Press; Oxford: Clarendon Press. 1986. P. 97-115.

COWIE J.W., BASSETT M.G. 1989. Global Stratigraphic Chart // Episodes. 1989. Vol. 12. N 2. Suppl.

(DEBRENNE F., ZHURAVLEV A.YU., ROZANOV A.YU.) ДЕБРЕННН Ф., ЖУРАВЛЕВ А.Ю., РОЗАНОВ А.Ю. Новые роды правильных днищевых и однокамерных археоциат из нижнего кембрия Сибири // Палеонт. журн. I988. № 4. С. 97-99.

(DEBRENNE F., ZHURAVLEV A.YU., ROZANOV A.YU.) ДЕБРЕННН Ф., ЖУРАВЛЕВ А.Ю., РОЗАНОВ А.Ю. Правильные археоциаты. М.: Наука, I989. I98 с. (Тр. ПИН АН СССР; Т. 233).

(Desisions..., 1973) Решение коллоквиума по трилобитам из пограничных слоев нижнего и среднего кембрия // Постановления МСК и его постоянных комиссий. Л., I973. Вып. I4. С. 54-56.

(FEDOROV A.B.) ФЕДОРОВ А.Б. Биостратиграфия и фауны древнейшего горизонта нижнего кембрия среднего течения р.Алдана // Стратиграфия и фации осадочных бассейнов Сибири. Новосибирск, I982. С. I8-25.

(FEDOROV A.B.) ФЕДОРОВ А.Б. Новые представители скелетной органики в стратотипических разрезах докембрия-кембрия Сибирской платформы (реки Алдан, Котуй) // Новые виды древних беспозвоночных и растений нефтегазоносных провинций Сибири. Новосибирск, I984. С. 5-9.

(FEDOROV A.B.) ФЕДОРОВ А.Б. Новые трубчатые проблематики из стратотипа томмотского яруса // Палеонт. журн. I986. № 3. С. II0-II2.

(FEDOROV A.B., EGOROVA L.I., SAVITSKY V.E.) ФЕДОРОВ А.Б., ЕГОРОВА Л.И., САВИЦКИЙ В.Е. Первая находка древнейших трилобитов из нижней части стратотипа томмотского яруса нижнего кембрия (р.Алдан) // Докл. АН СССР. I979. Т. 249. № 5. С. II88-II90.

(GUIDE...,1973) Путеводитель экскурсии по рекам Алдану и Лене (Международная экскурсия по проблеме границы кембрия и докембрия). Якутск, I973. II8 с.

(HARLAND W.B., COX A.V., LLEWELLYN P.G., PICKTON C.A.G., SMITH A.G., WALTERS R. A geologic time scale. Cambridge et al.: Cambridge University Press. 1982. 132 p.

HAQ B.U., VAN EYSINGA F.W.B. Geological time table. 4th ed. Amsterdam: Elsevier Science Publishers B.V., 1987.

HILL D. Archaeocyatha // Treatise on invertebrate paleontology/ C.Teichert, ed. Boulder; Laurence: University of Kansas Press, 1972. Pt. E. Vol. 1. P. 1-158.

(ISC, Decisions...,1983) Постановления Межведомственного стратиграфического комитета и его постоянных комиссий. Л., 1983. Вып. 21. 74 с.

(ISC, Resolution...,1959) Решения Межведомственного совещания по разработке унифицированных схем Сибири (Ленинград, 1956). Л.: Госгеолтехиздат, 1959.

(ISC, Resolution..., 1963) Решения Межведомственного совещания по разработке Унифицированных схем ЯАССР. М.: Госгеолтехиздат, 1963. С. 22-26.

(IVANOVSKAYA T.A.) ИВАНОВСКАЯ Т.А. Переходные слои кембрия и докембрия в разрезе Улахан-Сулугур (среднее течение р.Алдан) // Известия АН СССР. Сер. геол. 1980. № 1. С. 30-38.

(IVANTSOV A.YU.)ИВАНЦОВ А.Ю. Первые находки филлокарид в нижнем кембрии Якутии // Палеонт. журн. 1990. № 2. С. 00-00.

(KHOMENTOVSKY V.V., GIBSHER A.S.) ХОМЕНТОВСКИЙ В.В., ГИБШЕР А.С. Корреляция разрезов нижнего кембрия среднего течения р.Лена в переходной фациальной области // Поздний докембрий и ранний палеозой Сибири. Вендские отложения. Новосибирск, 1983. С. 3-15.

(KHOMENTOVSKY V.V., KARLOVA G.A.) ХОМЕНТОВСКИЙ В.В., КАРЛОВА Г.А. О нижней границе пестроцветной свиты в бассейне р.Алдан // Поздний докембрий и ранний палеозой Сибири. Сибирская платформа и внешняя зона Алтае-Саянской складчатой области. Новосибирск, 1986. С. 3-22.

(KHOMENTOVSKY V.V.,REPINA L.N.) ХОМЕНТОВСКИЙ В.В., РЕПИНА Л.Н. Нижний кембрий стратотипического разреза Сибири. М.: Наука, 1965. 200 с.

(KHOMENTOVSKY V.V., SHENFIL' V.YU.,YAKSHIN M.S.,BULATOV E.P.) ХОМЕНТОВСКИЙ В.В., ШЕНФИЛЬ В.Ю., ЯКШИН М.С., БУЛАТОВ Е.П. Опорные разрезы отложений верхнего докембрия и нижнего кембрия южной окраины Сибирской платформы. М.: Наука, 1972. 356 с. (Тр. ИГиГ СО АН СССР; Вып. 141).

KIRSCHVINK J.L., ROZANOV A.YU. Magnetostratigraphy of lower Cambrian strata from the Siberian Platform: a palaeomagnetic pole and a preliminary polarity time-scale // Geol. Mag. 1984. Vol. 121. N 4. P. 189-203.

(KONYUSHKOV K.N.) КОНЮШКОВ К.Н. Историческое развитие археоциат // Тез. докл. на годичн. сессии ВПО. Л., 1966. С. 17-18.

(LERMONTOVA E.V.) ЛЕРМОНТОВА Е.В. Нижнекембрийские трилобиты и брахиоподы Восточной Сибири. М.: Гостехиздат, 1951. 220 с.

(LUCHININA V.A.) ЛУЧИНИНА В.А. Палеоальгологическая характеристика раннего кембрия Сибирской платформы. Новосибирск: Наука, 1975. 97 с.

MAGARITZ M., HOLSER T., KIRSCHVINK J.L. Carbon-isotope events across the Precambrian./ Cambrian boundary on the Siberian Platform // Nature. 1986. Vol. 320. P. 258-259.

(MESHKOVA N.P.) МЕШКОВА Н.П. Хиолиты нижнего кембрия Сибирской платформы. Новосибирск: Наука, 1974. 110 с. (Тр. ИГиГ СО АН СССР; Вып. 97).

(MISSARZHEVSKY V.V., ROZANOV A.YU.) МИССАРЖЕВСКИЙ В.В., РОЗАНОВ А.Ю. Томмотский ярус и проблема нижней границы палеозоя // Стратиграфия нижнего палеозоя Центральной Европы. XXIII сес. МГК, Чехословакия, 1968. Докл. советских геологов. М.: Наука, 1968. С. 40-50.

NAZAROV M.A., BARSUKOVA L.D., KOLESOV G.M., ALEKSEEV A.S. Iridium abundances in the Precambrian-Cambrian boundary deposits and sedimentary rocks of Russian Platform // Abstr. Lunar and Planet. Sci. Cont., 14th. 1983. Pt.2. P.546-547.

(NIKOLAEVA I.V., ARKHIPENKO D.K.) НИКОЛАЕВА И.В., АРХИПЕНКО Д.К. (ред.) Минералогия и геохимия глауконита. Новосибирск: Наука, 1981. 110 с. (Тр. ИГиГ СО АН СССР; Вып. 515).

(NIKOLAEVA I.V., ZHURAVLEVA I.T., BORODAEVSKAYA Z.V., REPINA L.N., KOSUKHINA I.G., MESHKOVA N.P., PEL'MAN YU.L., MANDRIKOVA N.T., KAMENEVA M.YU., PEROZIO G.N., KOZLOV V.F.) НИКОЛАЕВА И.В., ЖУРАВЛЕВА И.Т., БОРОДАЕВСКАЯ З.В., РЕПИНА Л.Н., КОСУХИНА И.Г., МЕШКОВА Н.П., ПЕЛЬМАН Ю.Л., МАНДРИКОВА Н.Т., КАМЕНЕВА М.Ю., ПЕРОЗИО Г.Н., КОЗЛОВ В.Ф. Нижний кембрий юго-востока Сибирской платформы (литология, фации, палеоэкология). Новосибирск: Наука, 1986. 230 с. (Тр. ИГиГ СО АН СССР; Вып. 659).

(NIKOLAEVA I.V., BORODAEVSKAYA Z.V., PEROZIO G.N., BELOBORODOVA G.V.) НИКОЛАЕВА И.В., БОРОДАЕВСКАЯ З.В., ПЕРОЗИО Г.Н., БЕЛОБОРОДОВА Г.В. Нижний палеозой юго-востока Сибирской платформы. Породы нижнекембрийских отложений и их генезис. Новосибирск: Наука, 1987. 104 с. (Тр. ИГиГ СО АН СССР; Вып. 710).

(OGURTSOVA P.N.) ОГУРЦОВА Р.Н. Находки лонтоваских акритарх в отложениях томмотского яруса Оленекского поднятия// Известия АН СССР. Сер. геол. 1975. № 11. С. 84-89.

PAUL C.R.C., SMITH A.B. The early radiation and phylogeny of echinoderms // Biol. Rev. 1984. Vol. 59. P. 443-481.

(PEL'MAN YU.L.) ПЕЛЬМАН Ю.Л. Ранне- и среднекембрийские беззамковые брахиоподы Сибирской платформы. Новосибирск: Наука, 1977. 167 с. (Тр. ИГиГ СО АН СССР; Вып. 316).

(POKROVSKAYA N.V.) ПОКРОВСКАЯ Н.В. Стратиграфия кембрийских отложений юга Сибирской платформы // Вопросы геологии Азии. Т. 1. М.: Изд-во АН СССР, 1954. С. 444-465.

(POKROVSKAYA N.V.) ПОКРОВСКАЯ Н.В. О ярусном расчленении кембрия // Кембрийская система, ее палеогеография и проблема нижней границы. XX сес. МГК, Мексика, 1956. М.: Изд-во АН СССР, 1961. Т. 3. С. 256-274.

(REPINA L.N.) РЕПИНА Л.Н. Трилобиты нижнего кембрия юга Сибири (надсемейство Redlichioidea). М.: Наука, 1966. Ч. 1. 204 с.

(REPINA L.N.) РЕПИНА Л.Н. Трилобиты нижнего и среднего кембрия юга Сибири (надсемейство Redlichioidea). М.: Наука, 1969. Ч. П. 110 с. (Тр. ИГиГ СО АН СССР; Вып. 67).

(REPINA L.N.) РЕПИНА Л.Н. К вопросу о границе нижнего и среднего кембрия Сибирской платформы и сопредельных территорий // Биостратиграфия и палеонтология нижнего кембрия Европы и Северной Азии. М.: Наука, 1974. С. 76-103.

(REPINA L.N., KHOMENTOVSKY V.V., ZHURAVLEVA I.T., ROZANOV A.YU.) РЕПИНА Л.Н., ХОМЕНТОВСКИЙ В.В., ЖУРАВЛЕВА И.Т., РОЗАНОВ А.Ю. Биостратиграфия нижнего кембрия Саяно-Алтайской складчатой области. М.: Наука, 1964. 364 с.

(ROZANOV A.YU.) РОЗАНОВ А.Ю. Проблема нижней границы кембрия // Итоги науки и техники. Сер. геология. Общая геология. Стратиграфия. М.: ВИНИТИ, 1966. С. 92-111.

(ROZANOV A.YU.) РОЗАНОВ А.Ю. Принципы ярусного расчленения нижнего кембрия и вопросы соотношения лито- и биостратиграфических границ // Материалы к Ш коллоквиуму по археоциатам. М., 1970. С. 22-24.

(ROZANOV A.YU.) РОЗАНОВ А.Ю. Закономерности морфологической эволюции археоциат и вопросы ярусного расчленения нижнего кембрия. М.: Наука, 1973. 164 с. (Тр. ГИН АН СССР; Вып. 241).

(ROZANOV A.YU., MISSARZHEVSKY V.V.) РОЗАНОВ А.Ю., МИССАРЖЕВСКИЙ В.В. Биостратиграфия и фауна нижних горизонтов кембрия. М.: Наука, 1966. 126 с. (Тр. ГИН АН СССР; Вып. 148).

(ROZANOV A.YU., MISSARZHEVSKY V.V., VOLKOVA N.A., VORONOVA L.G., KRYLOV I.N., KELLER B.M., KOROLYUK I.K., LENDZION K., MICHNIAK R., PYKHOVA N.G., SIDOROV A.D.)
РОЗАНОВ А.Ю., МИССАРЖЕВСКИЙ В.В., ВОЛКОВА Н.А., ВОРОНОВА Л.Г., КРЫЛОВ И.Н., КЕЛЛЕР Б.М., КОРОЛЮК И.К., ЛЕНДЗИОН К., МИХНЯК Р., ПЫХОВА Н.Г., СИДОРОВ А.Д. Томмотский ярус и проблемы нижней границы кембрия. М.: Наука, 1969. 380 с. (Тр. ГИН АН СССР; Вып. 206).

(ROZANOV A.YU., SOKOLOV B.S., eds.) РОЗАНОВ А.Ю., СОКОЛОВ Б.С. (ред.). Ярусное расчленение нижнего кембрия. Стратиграфия. М.: Наука, 1984. 184 с.

(RUDAVSKAYA V.A., VASIL'EVA N.I.) РУДАВСКАЯ В.А., ВАСИЛЬЕВА Н.И. Акритархи и скелетная проблематика на границах венда, томмотского и атдабанского ярусов // Стратиграфия позднего докембрия и раннего палеозоя Сибирской платформы. Л., ВНИГРИ, 1985. С. 51-57.

(SAVITSKY V.E., ASTASHKIN V.A.) САВИЦКИЙ В.Е., АСТАШКИН В.А. Роль и масштабы рифообразования в кембрийской истории Сибирской платформы // Геология рифовых систем кембрия Западной Якутии. Новосибирск, 1979. С. 5-18. (Тр.СНИИГГиМС; Вып. 270).

(SAVITSKY V.E., EVTUSHENKO V.M., EGOROVA L.I., KONTOROVICH A.E.,SHABANOV YU.YA.) САВИЦКИЙ В.Е., ЕВТУШЕНКО В.М., ЕГОРОВА Л.И., КОНТОРОВИЧ А.Э., ШАБАНОВ Ю.Я. Кембрий Сибирской платформы (Юдомо-Оленекский тип разреза. Куонамский комплекс отложений). М.: Недра, 1972. 199 с.(Тр.СНИИГГиМС; Вып. 130).

(SHABANOV YU.YA., ASTASHKIN V.A., EGOROVA L.I.) ШАБАНОВ Ю.Я., АСТАШКИН В.А., ЕГОРОВА Л.И. О пограничных слоях нижнего и среднего кембрия в Анабаро-Синском фациальном регионе Сибирской платформы // Биостратиграфия и фауна пограничных отложений нижнего и среднего кембрия Сибири. Новосибирск: Наука, 1983. С. 27-40. (Тр. ИГиГ СО АН СССР; Вып. 548).

SPIZHARSKI T.N., ZHURAVLEVA I.T., REPINA L.N., ROZANOV A.YU., TCHERNYSHEVA N.YE., ERGALIEV G.H. The stage scale of the Cambrian System // Geol.Mag. 1986. Vol.123. N 4.P.387-392.

(SOKOLOV B.S., ZHURAVLEVA I.T., eds) СОКОЛОВ Б.С., ЖУРАВЛЕВА И.Т. (ред.). Ярусное расчленение нижнего кембрия Сибири. Атлас окаменелостей. М.: Наука, 1983. 216 с. (Тр. ИГиГ СО АН СССР; Вып. 558).

(STEPANOVA M.V., LUCHININA V.A.) СТЕПАНОВА М.В., ЛУЧИНИНА В.А. Нижняя граница кембрия по известковым водорослям // Границы крупных подразделений фанерозоя Сибири. Новосибирск, 1982. С. 39-46.

(SUVOROVA N.P.) СУВОРОВА Н.П. О ленском ярусе нижнего кембрия Якутии // Вопросы геологии Азии. Т. I. М.: Изд-во АН СССР, 1954. С. 466-483.

(SUVOROVA N.P.) СУВОРОВА Н.П. Трилобиты кембрия востока Сибирской платформы. Вып. I. Протолениды. М.: Изд-во АН СССР, 1956. 182 с. (Тр. ПИН АН СССР; Т. 63).

(SUVOROVA N.P.) СУВОРОВА Н.П. Трилобиты кембрия востока Сибирской платформы. Вып. 2. Оленеллиды - гранулярииды. М.: Изд-во АН СССР, 1960. 236 с. (Тр. ПИН АН СССР;Т.84).

(SUVOROVA N.P.) СУВОРОВА Н.П. Трилобиты коринексохиоды и их историческое развитие. М.: Наука, 1964. 319 с. (Тр. ПИН АН СССР; Т. 103).

(SUVOROVA N.P.) СУВОРОВА Н.П. О границе нижнего и среднего кембрия восточной Сибири // Бюлл. МОИП. Отд. геол. 1980. Т. 55. Вып. 2. С. 48-61.

(SUNDUKOV V.M.) СУНДУКОВ В.М. Использование новых данных по стратиграфии ботомского яруса нижнего кембрия юго-востока Сибирской платформы для крупномасштабных геолого-съемочных работ // Региональные и местные стратиграфические подразделения для крупномасштабного геологического

картирования Сибири. Новосибирск, 1986. С. 41-48.

(SUNDUKOV V.M., ZHURAVLEV A.YU.) СУНДУКОВ В.М., ЖУРАВЛЕВ А.Ю. Первые находки крибрициат в нижнем кембрии Сибирской платформы // Палеонтол. журн. 1989. № 3. С. 101-102.

(SYSOEV V.A.) СЫСОЕВ В.А. Биостратиграфия и хиолиты ортотециморфы нижнего кембрия Сибирской платформы. М.: Наука, 1972. 152 с.

(USHATINSKAYA G.T.) УШАТИНСКАЯ Г.Т. Находка древнейшей замковой брахиоподы // Палеонтол. журн. 1986. № 4. С. 102-103.

(VAL'KOV A.K.) ВАЛЬКОВ А.К. Распространение древнейших скелетных организмов и корреляция нижней границы кембрия в юго-восточной части Сибирской платформы // Поздний докембрий и ранний палеозой Сибири. Вендские отложения. Новосибирск, 1983. С. 37-48.

(VAL'KOV A.K.) ВАЛЬКОВ А.К. Биостратиграфия нижнего кембрия востока Сибирской платформы. Юдомо-Оленекский регион. М.: Наука, 1987. 136 с.

(VAL'KOV A.K., ZHURAVLEV A.YU., NUZHNOV S.V., REPINA L.N., ROZANOV A.YU., KHOMENTOVSKY V.V., SHABANOV YU.YA.) ВАЛЬКОВ А.К., ЖУРАВЛЕВ А.Ю., НУЖНОВ С.В., РЕПИНА Л.Н., РОЗАНОВ А.Ю., ХОМЕНТОВСКИЙ В.В., ШАБАНОВ Ю.Я. Экскурсия 053. Пограничные отложения кембрия и докембрия // 27-й Международный геологический конгресс. Якутская АССР. Сибирская платформа. Сводный путеводитель экскурсий 052, 053,054,055. М.: Наука, 1984. С. 174-199.

(VARLAMOV A.I., SUNDUKOV V.M.) ВАРЛАМОВ А.И., СУНДУКОВ В.М. Отложения зарифовой отмели кембрийских рифовых систем Западной Якутии // Геология рифовых систем кембрия Западной Якутии. Новосибирск, 1979. С. 31-49. (Тр. СНИИГГиМС; Вып. 270).

(VASIL'EVA N.I.) ВАСИЛЬЕВА Н.И. К систематике отряда Chancelloriida Walcott, 1920 (inc. sed.) из нижнекембрийских отложений востока Сибирской платформы // Проблематики позднего докембрия и палеозоя. М.: Наука, 1985. С.115-126. (Тр. ИГиГ СО АН СССР; Вып. 632).

(ZHURAVLEV A.YU.) ЖУРАВЛЕВ А.Ю. Некоторые правильные археоциаты атдабанского яруса среднего течения р.Лены // Бюлл.

МОИП. Отд. геол. 1981. Т. 56. № 3. С. 145.

(ZHURAVLEVA I.T.) ЖУРАВЛЕВА И.Т. Археоциаты Сибирской платформы. М.: Изд-во АН СССР, 1960. 344 с.

(ZHURAVLEVA I.T.) ЖУРАВЛЕВА И.Т. Раннекембрийские фациальные комплексы археоциат (р.Лена, среднее течение) // Проблемы биостратиграфии и палеонтологии нижнего кембрия Сибири. М.: Наука, 1972. С. 31-109.

(ZHURAVLEVA I.T.) ЖУРАВЛЕВА И.Т. Сахайская органогенная полоса // Среда и жизнь в геологическом прошлом. Вопросы экостратиграфии. Новосибирск: Наука, 1979. С. 128-154. (Тр. ИГиГ СО АН СССР; Вып. 431).

(ZHURAVLEVA I.T., KORSHUNOV V.I.) ЖУРАВЛЕВА И.Т., КОРШУНОВ В.И. Стратиграфия нижнего кембрия Хараулахских гор // Геология и геофизика. 1965, № 11. С. 45-55.

(ZHURAVLEVA I.T., KORSHUNOV V.I., LUCHININA V.A., MESHKOVA N.P., MINAEVA M.A., PEL'MAN YU.L., REPINA L.N.) ЖУРАВЛЕВА И.Т., КОРШУНОВ В.И., ЛУЧИНИНА В.А., МЕШКОВА Н.П., МИНАЕВА М.А., ПЕЛЬМАН Ю.Л., РЕПИНА Л.Н. Опорные скважины верхнего докембрия - нижнего кембрия в стратотипическом районе среднего течения р.Лены // Биостратиграфия и палеонтология нижнего и среднего кембрия Азиатской части СССР. М.: Наука, 1983. С. 3-44. (Тр. ИГиГ СО АН СССР; Вып. 541).

(ZHURAVLEVA I.T., KORSHUNOV V.I., ROZANOV A.YU.) ЖУРАВЛЕВА И.Т., КОРШУНОВ В.И., РОЗАНОВ А.Ю. Атдабанский ярус и его обоснование по археоциатам в стратотипическом разрезе // Биостратиграфия и палеонтология нижнего кембрия Сибири и Дальнего Востока. М.: Наука, 1969. С. 3-59.

(ZHURAVLEVA I.T., LUCHININA V.A., MESHKOVA N.P., PEL'MAN YU.L., REPINA L.N., BORODAEVSKAYA Z.) ЖУРАВЛЕВА И.Т., ЛУЧИНИНА В.А., МЕШКОВА Н.П., ПЕЛЬМАН Ю.Л., РЕПИНА Л.Н., БОРОДАЕВСКАЯ З.В. Экология населения раннекембрийского бассейна Сибирской платформы (на примере Атдабанского рифоида) // Проблемы экологии фауны и флоры древних бассейнов. М.: Наука, 1983. С. 33-43. (Тр. ПИН АН СССР; Т. 194).

(ZHURAVLEVA I.T., MESHKOVA N.P., LUCHININA V.A.) ЖУРАВЛЕВА И.Т., МЕШКОВА Н.П., ЛУЧИНИНА В.А. Геологический профиль через район стратотипического разреза нижнего кембрия в среднем течении р.Лены. Новосибирск: Наука, 1969. 172 с.

Abaimova, G.P., Siberian Sci.-Res. Inst. Geol. Geoph. Min. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Aceñolaza, F.G., Inst. Super. de Correl. Geol., Univ. de Tucuman, Miguel Lillo 205, 4000, San Miguel de Tucuman, Argentina.

Ahleberg, P., Avdelningen hist. geol. paleont., Geol. Inst., Sölvegaten 13, S-22362 Lund, Sweden.

Aitken, J.D., Geol. Surv. Canada, 3303 33rd Str., N.W. Calgary, Alberta, T2L 2A7, Canada.

Alavi, M., Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Alavi Naeini, M., Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Andrianov, I.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Andrianova, T.A., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Apollonov, M.K., Inst. Geol. Sci. Kazakh S.S.R., ul. Kalinina 69a, Alma-Ata, 480100, Kazakh S.S.R., U.S.S.R.

Aseeva, E.A., Inst. Geol. Sci., Ukrainian S.S.R., ul. Chkalova 55b, Kiev, 252054, Ukrainian S.S.R., U.S.S.R.

Astashkin, V.A., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Ausich, W.I., Dept. Geol. & Miner., The Ohio State Univ., 125 S.Oval Mall, Columbus, OH 43210-1398, U.S.A.

Awramik, S.M., Dept. Geol. Sci., Univ. California, Santa Barbara, California, 93106, U.S.A.

Babcock, L.E., Dept. Geol., Univ. Kansas, Lawrence, KS 66045-2124, U.S.A.

Barnes, Ch.R., Geol. Surv. Canada, 601 Booth Str., Ottawa, K1A OE8, Canada.

Bednarczyk, W., Inst. Palaeobiol., Polish Acad. Sci., Al. Żwirki i Wiguru 93, PL-02-089, Warsaw, Poland.

Belyaeva, G.V., Far Eastern Geol. Inst., Far Eastern Sci. Centre, pr. Stoletiya 159, Vladivostok, 690022, U.S.S.R.

Bengtson, S., Palaeont. Inst., Box 558, S-751, 22 Uppsala 1, Sweden.

Bernal Barreiro, G.M., Dept. Paleont., Fac. Cie. Geol., Ciudad Univ., s/n, 28040, Madrid, Spain.

Bobrov, A.K., Yakutian Geol. Inst., Siberian Branch, U.S.S.R. Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Bokova, A.R., Yakutian Geol. Inst., Siberian Branch, U.S.S.R. Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Bondarev, V.I., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Bordonaro, O., Dept. Geol., Conicet y Univ. Nac. de San Juan, San Juan, Argentina.

Bottjer, D.J., Dept. Geol. Sci., Univ. S.California, University Park, Los Angeles, California 90089-0741, U.S.A.

Bragin, S.S., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Brasier, M.D., Dept. Earth Sci., Univ. Oxford, Park Road, Oxford OX1 3PR, England, U.K.

Burzin, M.B., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Carcassi, A.C., Inst. Fisiologia, Univ. Cagliari, v. Porcell, 09100, Cagliari, Italy.

Chang Wen-Tang, Nanjng Inst. Geol. Palaeont., Acad. Sinica, 39 East Beijing Rd., Nanjng, P.R. China.

Chen Menge, Inst. Geol., Chinese Acad. Geol. Sci., 26 Baiwanzhuang Rd., Beijing, 100037, P.R. China.

Chernysheva, N.E., All-Union Geol. Inst., Sredny pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Chimit Tseren, Geol. Inst., M.R.P. Acad. Sci., pr. marshala Zhukova 63, p/o 51, Ulan-Bator, Mongolia.

Cocozza, T., Dept. Sci. della Terra, Univ. Siena, v. della Cerchia 3, 53100, Siena, Italy.

Conway Morris, S., Dept. Earth Sci., Univ. Cambridge, Downing Str., Cambridge, CB2 3EQ, England, U.K.

Cook, H.E., III, Branch Sed. Processes, U.S.Geol. Surv., 345 Middlefield Rd., Mailstop 999, Menlo Park, California 94025, U.S.A.

Cooper, R.A., New Zealand Geol. Surv., P.O. Box 30368, Lower Hutt, New Zealand.

Courjalt-Radé, P., Lab. Min. Cryst., Univ. Paul Sabatier, 39, Allées Jules Guesde, 31400 Touloose, France.

Cowie, J.W., Dept. Geol., Univ. Bristol, Bristol, BS8 1RJ, England, U.K.

Crimes, T.P., Dept. Geol., Univ., Brownlow Str., P.O. Box 147, Liverpool, L69 3BX, England, U.K.

Dalmatov, B.A., Prod. Geol. Comp. "Buryatgeologiya", Ulan-Ude, Buryat A.S.S.R., U.S.S.R.

Debrenne, F., Inst. Paléont., C.N.R.S., E.R. 154, 8 Rue de Buffon, 75005, Paris, France.

Dmitrovskaya, Yu.E., Kam NIIKIGS, Geol. Prod. Comp. "Nedra", p/o Kuznichikha, Yaroslavl', 152210, U.S.S.R.

Dong Xi-ping, Dept. Geol., Peking Univ., Beijing, P.R.China.

Doré, F., Lab. Géol. Armoricaina, Univ. Caen, 14000, Caen, France.

Dorzhnamzhaa, D., Geol. Inst., M.R.P. Acad. Sci., pr. marshala Zhukova 63, p/o 51, Ulan-Bator, Mongolia.

Droser, M., Dept. Geol., Oberlin College, Oberlin. Ohaio 44074, U.S.A.

Dubinina, S.V., Geol. Inst., U.S.S.R. Acad. Sci., Pyzhevsky per. 7, Moscow, 109017, U.S.S.R.

Dyatlova, I.N., Geol. Exp., Geol. Prod. Comp. "Krasnoyarskgeologiya", ul. Berezina 3, Krasnoyarsk, 660020, U.S.S.R.

Egorova, L.I., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Endonzhamts, Zh., Geol. Inst., M.R.P. Acad. Sci., pr. marshala Zhukova 63, p/o 51, Ulan-Bator, Mongolia.

Erdtmann, B.-D., Geol.-Palaeont. Inst., Tech. Univ. Berlin, EB10, Hardenbergstrasse 42, D-1000, Berlin-12, Fed. Rep. Germany.

Ergaliev, G.Kh., Inst. Geol. Sci., Acad. Sci. Kazakh. S.S.R., ul. Kalinina 69a, Alma-Ata, 480000, Kazakh S.S.R., U.S.S.R.

Ermak, V.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Erwin, D.H., Dept. Geol. Sci., Michigan State Univ., East Lansing, Michigan, 48824-1115, U.S.A.

Esakova, N.V., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Prof-

soyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Fatká, O., Ústeředni Ústav Geol., 11821 Praha 1, Malostranské nám. 19 poštovni přihrádka 85, Praha 011, Czechoslovakia.

Fedonkin, M.A., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Fedorov, A.B., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Fletcher, P., British Geol. Surv., Murchison House, West Mains Rd., Edinburgh, EH9 3LA, Scotland, U.K.

Preyer, G., VEB Geol. Forschung u. Erkundung, Halsbrücker Str. 31a, Freiberg, DDR-9200.

Gámez, J.A., Dept. Paleont., Faculdad de Cie. de la Univ. de Zaragoza, 50009, Zaragoza, Spain.

Gandin, A., Inst. Geol. Paleont., v. delle Cerchia 3, 53100, Siena, Italy.

Gangloff, R.A., Univ. of Alaska Mus., 907 Yukon OR, Fairbanks, Alaska 99775-1200, U.S.A.

Gatehouse, C., South Australian Dept. of Mines and Energy, P.O. Box 151, Eastwood, S.A. 5063, Australia.

Gedik, I., Jeol. Müh. Bölümü, Karadeniz Tek. Üniv., 61080, Trabzon, Turkey.

Geyer, G., Inst. für Paläont., Univ. Würzburg, Pleicherwall 1, D-8700, Würzburg, Fed. Rep. Germany.

Gibsher, A.S., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Gil Cid, D., Dept. Paleont., Fac. Cie. Geol., Univ. Ciudad, Madrid 3, Spain.

Gozalo, R., Dept. Paleont., Fac. Cie., Univ. Zaragoza, 50009, Zaragoza, Spain.

Grant, S.W.F., Mus. Comparative Zool., Harvard Univ., Cambridge, MA02138, U.S.A.

Gravestock, D.I., South Australian Dept. of Mines and Energy, P.O. Box 151, Eastwood, S.A. 5063, Australia.

Gridina, N.M., CPSE "Centrkazgeologiya", ul. Dubovskaya 20, Karaganda, 470076, Kazakh S.S.R., U.S.S.R.

Gurari, F.G., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Gureev, Yu.A., Inst. Geol. Sci., Ukrainian S.S.R. Acad. Sci., ul. Chkalova 55b, Kiev, 252054, Ukrainian S.S.R., U.S.S.R.

Hamdi, B., Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Hamedi, I., Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Heinsalu, H., Inst. Geol., Estonian S.S.R. Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Hofmann, H.J., Dept. Geol., Univ. Montreal, P.O. Box 6128, Sta. A, Montreal, Canada.

Hughes, N.C., Dept. Geol., Trinity College, Univ. Dublin, Dublin-2, Ireland.

Jago, J.B., Gaptrell School of Mining, Metallurgy & Appl. Geol., South Australian Inst. Tech., The Levels, Poorana, P.O. Box 1, Ingle Farm, S.A. 5098, Australia.

James, N.P., Dept. Geol. Sci., Queen's Univ., Kingston, K7L 3N6, Ontario, Canada.

Jankauskas, T.V., Lithuanian Sci.-Res. Geol.-Expl. Inst., ul. Ševčenkos 13, Vilnius, 232600, Lithuania.

Jell, P.A., Queensland Mus., Gregory Terrace, Fortitude Valley, Queensland 4006, Australia.

Jendrika-Fuglewicz, B., Inst. Geol., ul. Rakowiecka 4, PL-00-975, Warsaw, Poland.

Jenkins, R.T.F., Univ. Adelaide, G.P.O. Box 498, Adelaide, S.A. 5001, Australia.

Jiang Zhi Wen, Yunnan Inst. Geol. Sci., Baita Rd., Kunming City, Yunnan Prov., 650011, P.R. China.

Ivantsov, A.Yu., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Kaljo, D., Inst. Geol., Estonian S.S.R. Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Kanygin, A.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Karlova, G.A., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Karogodin, Yu.N., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Kashina, L.N., Dept. Natur.-Geogr., Kirov State Pedagogical Inst., ul. Lenina, 108, Kirov, 610036, U.S.S.R.

Kazansky, Yu.N., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Khayrullina, T.I., Middle Asian Inst. Geol. Miner. Resour., ul. Shevchenko 15, Tashkent, 700061, Uzbek S.S.R., U.S.S.R.

Khodghi Khasrghi, Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Kindle, C.H., 332 N. Midland Ave., Upper Nyack, NY 10960, U.S.A.

Kirjanov, V.V., Inst. Geol. Sci., Ukrainian S.S.R. Acad. Sci., ul. Chkalova 55b, Kiev, 252054, Ukrainian S.S.R., U.S.S.R.

Kirschvink, J.L., Div. Geol. Sci., Californian Inst. Tech., Pasadena, California, 91125, U.S.A.

Knoll, A.H., Botanic Mus., Harvard Univ., 26 Oxford Str., Cambridge, M.A. 02138, U.S.A.

Kokoulin, M.L., All-Union Sci-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 192104, U.S.S.R.

Kolosov, P.N., Yakutian Geol. Inst., Siberian Branch, U.S.S.R. Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Kolosova, S.P., Yakutian Geol. Inst., Siberian Branch, U.S.S.R, Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Koneva, S.P., Inst. Geol. Sci., Acad. Sci. Kazakh. S.S.R., ul. Kalinina 69a, Alma-Ata, 480091, Kazakh S.S.R., U.S.S.R.

Konyaeva, I.A., Geol.-Prod. Comp. "Zapsibgeologiya", Pionersky pr. 20, Novokuznetsk, 654027, U.S.S.R.

Konyushkov, K.N., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Korenchuk, L.V., Inst. Geol. Sci., Ukrainian S.S.R. Acad. Sci., ul. Chkalova 55b, Kiev, 252054, Ukrainian S.S.R., U.S.S.R.

Korolev, V.G., Inst. Geol., Kirghiz S.S.R. Acad. Sci., bul. Dzerzhinskogo 30, Frunze, GSP, 720481, Kirghiz S.S.R., U.S.S.R.

Kotel'nikov, D.V., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Kras'kov, L.N., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Kruse, P.D., Northern Territory Dept. Mines Energy, G.P.O. Box 2901, Darwin, N.T. 0801, Australia.

Landing, E., New York State Mus. Albany, New York 12230, U.S.A.

Lazarenko, N.P., Sci-Prod. Comp. "Sevmorgeo", nab. Moyka 120, Leningrad, 190021, U.S.S.R.

Lendzion, K., Inst. Geol., ul. Rakowiecka 4, PL-00-975, Warsaw, Poland.

Liñan, E., Dept. Paleont., Fac. de Cie. de la Univ. de Zaragoza, 50009, Zaragoza, Spain.

Lipps, J.H., Dept. Geol., Univ. California, Davis, California, 95616, U.S.A.

Li Shan-ji, Chengdu Inst. Geol. Miner. Resour., Chinese Acad. Geol. Sci., North Renmin Rd, Chengdu, Sichuan Prov., 610082, P.R. China.

Lisogor, K.A., V.I.Lenin Kazakh Politechnical Inst., ul. Satpaeva 22, Alma-Ata, Kazakh S.S.R., U.S.S.R.

Luchinina, V.A., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 6300090, U.S.S.R.

Ludvigsen, R., Dept. Geol., Univ. Toronto, Ontario M5S 1A1, Canada.

Luo Hui-lin, Yunnan Inst. Geol., Baita Rd, Kunming, 650011, Yunnan Prov., P.R.China.

Lyashenko, A.N., Inst. Geol. Sci., Ukrainian S.S.R. Acad. Sci., ul. Chkalova 55b, Kiev, 252054, Ukrainian S.S.R., U.S.S.R.

Łydka, K., Dept. Geol., Univ. Warsaw, Al. Żwirki i Wigury 93, PL-02-089, Warsaw, Poland.

Magaritz, M., The Weizmann Inst. Sci., Rehovot, 76100, Israel.

Mambetov, A.M., Inst. Geol., Kirghiz S.S.R. Acad. Sci., bul. Dzerzhinskogo 30, GSP, Frunze, 720481, Kirghiz S.S.R., U.S.S.R.

Martin, F., Dept. Paleont.,Inst. Roy. Sci. Nat., Rue Vautier, 29B-1040-Bruxelles, Belgium.

McCollum, L.B., Dept. Geol., Eastern Washington Univ., Ewu Cheney, WA99004, U.S.A.

Mackinnon, D.I., Geol. Dept., Univ. Canterbury, Christchurch, New Zeland.

McMenamin, M.A., Dept. Geogr. Geol., Clapp Lab., Mount Holyoke College, South Hadly, Massachusetts 01075-1481, U.S.A.

Mel'nikova, L.M., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Mens, K., Inst. Geol., Estonian S.S.R., Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Miller, J.F., Dept. Geol. Geogr., Southwest Missouri State Univ., Springfield, M.O 65802, U.S.A.

Moczydłowska-Vidal, M., Lund Univ., Box 740, Kemicentrum Micropalaeont. Lab., S-22100, Lund 7, Sweden.

Moreno-Eiris, E., Dept. Paleont., Fac. de Cie. Geol., 2 planta, Ciudad Univ., 280040, Madrid 3, Spain.

Müller, K., Inst. Paläont. der Rheinishen Friedrich-Wilhelms-Univ., Nussallee 8, 5300 Bonn 1, Fed. Rep. Germany.

Myrow, P., Dept. Geol., Colorado College, Colorado Springs, CO 80903, U.S.A.

Narbonne, G.M., Dept. Geol. Sci., Queen's Univ., Kingston, Ontario, K7L 3N6, Canada.

Navai, J., Geol. Surv. Iran, P.O. Box 13185-1494, Tehran, Iran.

Nicholas, C.J., Dept. Earth Sci., Univ. Cambridge, Downing Street, Cambridge, CB2 3EQ, England, U.K.

Nikolaev, V.G., Yakutian Geol. Inst., Siberian Branch, U.S.S.R. Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Ogienko, L.V., Vost Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., ul. Dekabr'skikh sobytiy 29, Irkutsk, 664026, U.S.S.R.

Ogurtsova, R.N., Inst. Geol., Kirghiz S.S.R. Acad. Sci., bul. Dzerzhinskogo 30, Frunze, GSP, 720481, Kirghiz S.S.R., U.S.S.R.

Orlowski, S., Dept. Geol., Univ. Warsaw, Al. Żwirki i Wigury 93, PL-02-089, Warsaw, Poland.

Osadchaya, D.V., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Paalits, I., Tartu Univ., ul. Vanemuine 46, Tartu, 202400, Estonian S.S.R., U.S.S.R.

Paczesna, I., Inst. Geol., ul. Rakowiecka 4, PL-00-975, Warsaw, Poland.

Pak, K.L., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Pakhomov, N.N., Geol.-Prod. Comp. "Chitageologiya", ul.Kalinina 91/15, Chita, 672000, U.S.S.R.

Palacios, T., Dept. Geol., Univ. de Extremadura, Extremadura, Badajoz, Spain.

Palmer, A.R., Geol. Soc. Amer., 3300 Penrose Place, P.O. Box 9146, Boulder, Colorado, 80301, U.S.A.

Paškevičiene, L.T., Lithuanian Sci.-Res. Geol.-Expl. Inst., ul. Ševčenkos 13, Vilnius, 232600, Lithuania.

Peel, J.S., Dept. Strat. & Structural Geol., Geol. Surv., Greenland, Øster, Volgade 10, DK-1350 København, K, Denmark.

Pegel', T.N., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Pemberton, S.G., Dept. Geol., Univ. Alberta, Edmonton, Alberta, T662E3, Canada.

Perejón, A., Dept. Paleont., Fac. de Cie. Geol., 2 planta, Ciudad Univ., 28040, Madrid 3, Spain.

Pereladov, V.S., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr., 67, Novosibirsk, 630104, U.S.S.R.

Petrunina, Z.E., Palaeont. Div., Geol.-Prod. Comp. "Zapsibgeologiya", ul. Ordzhonikidze 9, Novokuznetsk, 554011, U.S.S.R.

Pham Kim Ngan, Vien Dia Chat va Khoang san, Thanh Xuan, Dongda, Hanoi, Viêt Nam.

Pillola, G.L., Lab. de Micropaléont. & Paléont., Univ. Rennesi, Rennes 35042, France.

Pirrus, E.A., Inst. Geol., Estonian S.S.R. Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Piskun, L.V., Byelorussian Sci.-Res. Geol.-Expl. Inst., Staroborisovsky Trakt 14, Minsk, 220600, Byelorussian S.S.R., U.S.S.R.

Pittau, P.P., Dept. Sci. della Terra, Univ. Cagliari, v. Trentino 51, 09100, Cagliari, Italy.

Pojeta, J., Jr., U.S. Geol. Surv., Natl. Mus. of Nat. Hist., Smithsonian Inst., E-501, Washington, D.C. 20560, U.S.A.

Polyakova, G.A., All-Union Sci-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 192104, U.S.S.R.

Popov, A.M., Far Eastern Geol. Inst., Far Eastern Sci. Centre, pr. Stoletiya 159, Vladivostok, 690022, U.S.S.R.

Popov, L.E., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Pratt, B.R., Dept. Geol. Sci., Univ. Saskatchewan, Saskatoon, Saskatchewan, S7N OWO, Canada.

Puura, I., Inst. Geol., Estonian S.S.R. Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Pyanovskaya, I.A., Middle Asian Inst. Geol. Miner. Resour., ul. Shevchenko 15, Tashkent, 700061, Uzbek S.S.R., U.S.S.R.

Pyatiletov, V.G., Far Eastern Inst. Miner. Resour., Khabarovsk, U.S.S.R.

Qian Yi, Nanjing Inst. Geol. Palaeont., Acad. Sinica, 39 East Chi-Ming-Ssu, Nanjing, P.R. China.

Ragozina, A.L., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868, GSP-7, Moscow, B-321, U.S.S.R.

Rai Vibuti, Dept. Geol., Lucknow Univ., Lucknow 226007, India.

Rees, M.H., Dept. Geol. Sci., Univ. Nevada, 4505 Maryland Parkway, Las Vegas, Nevada, 89154, U.S.A.

Repina, L.N., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Ripperdan, R.L., Dept. Geol. Sci., Californian Inst. Tech., Pasadena, California 91125, U.S.A.

Robison, R.A., Dept. Geol., Univ. Kansas, Lawrence, Kansas 66044, U.S.A.

Romanenko, E.V., Palaeont. Div., Geol.-Prod. Comp. "Zapsibgeologiya", ul. Ordzhonikidze 9, Novokuznetsk, 554011, U.S.S.R.

Rowland, S.M., Dept. Geol. Sci., Univ. Nevada, 4505 Maryland Parkway, Las Vegas, Nevada 89154, U.S.A.

Rozanov, A.Yu., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Rozhnov, S.V., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow B-321, U.S.S.R.

Rozov, S.N., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Rozova, A.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Rudavskaya, V.A., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Runnegar, B.N., Dept. Earth & Space Sci., Univ. California, Los Angeles, CA 90024-1567, U.S.A.

Rushton, A.W.A., Britain Geol. Surv., Keyworth, Notts, England, U.K.

Salikhova, A.K., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Savarese, M., Dept. Geol., Indiana Univ., 1005 East Tenth Str., Bloomington, Indiana 47405, U.S.A.

Sayutina, T.A., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Semikhatov, M.A., Geol. Inst., U.S.S.R. Acad. Sci., Pyzhevsky per. 7, Moscow, 109017, U.S.S.R.

Sennikov, N.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Shabanov, Yu.Ya., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Shah, S.K., Dept. Geol., Univ. Jammu, Jammu-180001, India.

Shanchi Peng, Nanjing Inst. Geol. Palaeont., Acad. Sinica, 39 East Chi-Ming-Ssu, Nanjing, P.R. China.

Shergold, J.H., Bureau Miner. Resour., P.O. Box 378, Canberra, A.C.T. 2601, Australia.

Sheshegova, L.I., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Shipitsin, V.A., Geol.-mapping Exp., Geol.-Prod. Comp. "Krasnoyarskgeologiya", ul. Berezina 3, Krasnoyarsk, 660020, U.S.S.R.

Shishkin, B.B., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Signor, P.W., III, Dept. Geol., Univ. California, Davis, California 95616, U.S.A.

Sobolev, L.I., Far Eastern Sci.-Res. Inst. Miner. Resour., Khabarovsk, U.S.S.R.

Sochava, A.V., Inst. Geol. & Geophron. of the Precambrian, nab. Makarova 2, Leningrad, 199164, U.S.S.R.

Solov'ev, I.A., All-Union Sci.-Res. Inst. Okeangeologiya, Prod.-Sci. Comp. "Sevmorgeologiya", nab. Moyka 120, Leningrad, 190121, U.S.S.R.

Spizharsky, T.N., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.

Stitt, J.H., Dept. Geol., Univ. Columbia, Columbia, Missouri 65201, U.S.A.

Strauss, H., Ruhr-Univ. Bochum, Fak. Geowiss., Inst. Geol., Postfach 102148, Universitätsstr. 150, Fed. Rep. Germany.

Sukhov, S.S., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Sundukov, V.M., Sibirian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Suvorova, N.D., Palaeont. Inst., U.S.S.R. Acad. Sci., ul.Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Szaniawski, H., Inst. Palaeobiol., Polish Acad. Sci., Al. Zwirki i Wiguru 93, PL-02-089, Warsaw, Poland.

Taylor, M.E., U.S. Geol. Surv., Palaeont. & Stratigr. Branch, M.S. 919, Denver, Colorado, 80225, U.S.A.

Theokritoff, G., Dept. Geol. Sci., Rutgers Univ., Newark, NJ 07102, U.S.A.

Tikhomirova, N.S., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, U.S.S.R.

Timokhin, A.V., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Titorenko, T.N., Irkutsk Stat. Univ., ul. Karla Marksa 1, Irkutsk, 664003, U.S.S.R.

Usacheva, I.V., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Ushatinskaya, G.T., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Usychenko, O.N., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Val'kov, A.K., Yakutian Geol. Inst., Siberian Branch, U.S.S.R. Acad. Sci., pr. Lenina 39, Yakutsk, 677982, U.S.S.R.

Varlamov, A.I., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Vasil'eva, N.I., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Vidal, G., Lund Univ., Box 740, Kemicentrum Micropalaeont. Lab., S-22100, Lund 7, Sweden.

Viira, V., Inst. Geol., Estonian S.S.R. Acad. Sci., bul. Estonia 7, Tallinn, 200101, Estonian S.S.R., U.S.S.R.

Viks, E.G., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Vil'mova, E.S., Div. Geol., Chita Pedagogical Inst., ul.Kalinina 117, Chita, 672026, U.S.S.R.

Volkova, N.A., Geol. Inst., U.S.S.R. Acad. Sci., Pyzhevsky per. 7, Moscow, 109017, U.S.S.R.

Vudiga, D.J., Geol. Surv. & Miner. Dept., P.O. Box. 9, Entebbe, Uganda.

Westrop, S.R., Dept. Earth Sci., Memorial Univ. Newfoundland, St. John's, Newfoundland A1B 3X5, Canada.

Wolfart, R., Federal Inst. Geosci. & Natur. Resour., Hannover, P.O. Box 530151, Stilleweg 2, Fed. Rep. Germany.

Wood, R., Dept. Earth Sci., Univ. Cambridge, Downing Str., Cambridge, CB2 3EQ, England, U.K.

Wright, J., Pacific Northwest Lab., P.O. Box 999, M.S. K6-84, West Richland, Washington 99352, U.S.A.

Wrona, R., Inst. Palaeobiol., Polish Acad. Sci., Al. Żwirki i Wigury 93, PL-02-089, Warsaw, Poland.

Xiang Li-wen, Inst. Geol., Chinese Acad. Geol. Sci., 26 Baiwanzhuang Rd, Beijing, 100037, P.R. China.

Yadrenkina, A.G., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.

Yin Gongzheng, Reg. Geol. Surv. Team No 108 Guizhou Prov., Huishui County, Guizhou Prov., P.R. China.

Young, G.A., Dept. Geol., Univ. of New Brunswick, P.O. Box 4400, Fredericton, New Bruswick, E3B 5A3, Canada.

Yuan Ke-xing, Nanjing Inst. Geol. & Palaeont., Acad. Sinica, 39 East Chi-Ming-Ssu, Nanjing, P.R. China.

Yü Wen, Nanjing Inst. Geol. & Palaeont., Acad. Sinica, 39 East Chi-Ming-Ssu, Nanjing, P.R. China.

Yue Zhao, Inst. Geol., Chinese Acad. Geol. Sci., 26 Baiwanzhuang Rd, Beijing, 100037, P.R. China.

Zakharov, A.V., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Zaslavskaya, N.M., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Zazhigin, S.V., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Zhang Zhongyin, Dept. Earth Sci., Nanjing Univ., Nanjing, P.R. China.

Zharkov, M.A., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Zhegallo, E.A., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Zhemchuzhnikov, V.G., Inst. Geol. Sci. Kazakh S.S.R., ul. Kalinina 69a, Alma-Ata, 480100, Kazakh S.S.R., U.S.S.R.

Zhuravlev, A.Yu., Palaeont. Inst., U.S.S.R. Acad. Sci., ul. Profsoyuznaya 123, 117868 GSP-7, Moscow, B-321, U.S.S.R.

Zhuravleva, I.T., Inst. Geol. Geoph., Siberian Branch, U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, 630090, U.S.S.R.

Zhu Zhao-ling, Nanjing Inst. Geol. & Palaeont., Acad. Sinica, 39 East Chi-Ming-Ssu, Nanjing, P.R. China.

Zinchenko, V.N., All-Union Sci.-Res. Geol.-Expl. Inst., Liteyny pr. 39, Leningrad, 191104, U.S.S.R.

Bakhturov, S.F., Inst. Geol. Geoph., Siberian Branch., U.S.S.R. Acad. Sci., Universitetsky Pr. 3, Novosibirsk, 630090, U.S.S.R.

Baytorina T.B., Inst. Geol. Sci., Acad. Sci. Kazakh S.S.R., ul. Kalinina 69a, Alma-Ata, 480000, Kazakh S.S.R., U.S.S.R.

Chen Yun-yuan, Nanjing Inst. Geol. Palaeont., Acad. Sinica, 39 East Beijing Rd, Nanjing, P.R. China.

Duokenel, G.L., Liberian Geol. Surv., Ministry of Lands Mines. & Energy, P.O.Box 10-9024, 1000 Monrovia, 10 Liberia.

Fayzulina Z. Kh., Vost Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resour., ul.Dekabr'skikh Sobytiy 29, Irkutsk, 664026, U.S.S.R.

Ginilovskaya, M.B., Inst. Geol. & Geochron. of the Precambrian, nab. Makarova 2, Leningrad, 199164, U.S.S.R.

Gopendra Kumar, Geol. Surv. India, Himalayan Geol. Div., B-11 H Rd, Mahanagar Extension, Luckhow 226006, India.
Sdzuy, K., Inst. Paleont., Univ., Pleicherw. 3, Würzburg D-8700, Fed. Rep. Germany.
Vaganova, N.V., Siberian Sci.-Res. Inst. Geol. Geoph. Miner. Resaur., Krasny pr. 67, Novosibirsk, 630104, U.S.S.R.
Gogin, I.J., All-Union Geol. Inst., Sredniy pr. 74, V/O, Leningrad, 199026, U.S.S.R.
Zinowenko, G.W., Institit. Geochem. and Geophys. AS BSSR, 7 Zhodinskaya st., 220600 Minsk, U.S.S.R.
Hinz, J., Rhein. Friedr. Wilh. Universitat, Nussalle 8, D-5300 Bonn 1, Germany.
Qin Zheng-yong, Tianjin Institute of Geology and Mineral resources 4, 8 Road, Dazhign, Tianjin 300170, P.R.China.
Berg-Madsen, V., Dept. of Geol. Univers. of Stockholm, Box 6801, S-10691, Sweden.
Lu Songnian, Tianjin Inst. of Geology and Mineral resources 4, 8 Road, Dazhign, Tianjin 300170, P.R.China.
Mac Kinnon Dand, Geol. Depart., Univers.of Conterbury, Christchurch, New Zealand.
Kazmierczak J., Institit. of Paleobiology, Polish Academy of Sciences, Zwirki i Wigury 93, PL-02089 Warszawa, Poland.
Khomentovsky V.V., Inst. Geol. Geoph., Siberian Branch U.S.S.R. Acad. Sci., Universitetsky pr. 3, Novosibirsk, U.S.S.R.

CONTENTS

СОДЕРЖАНИЕ

Утверждено к печати
Институтом геологии и геофизики СО АН СССР

Технический редактор Н.Н.Александрова

Подписано к печати I8.04.90.
Бумага 60x84/I6. Печ.л.7,25+2 вкл. Уч.-изд.л.8,0.
Тираж 450. Заказ I62. Цена 60 коп.

Институт геологии и геофизики СО АН СССР
Новосибирск, 90. Ротапринт.