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LOWER AND MIDDLE CAMBRIAN BOUNDARY AND TRILOBITES FROM NORTHEAST SIBERIAN PLATFORM

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INTRODUCTION

The Siberian Platform is an ancient piece of the continental crust that was an island continent in Cambrian time. Three distinct facies belts comprise the Early Cambrian and early Middle Cambrian of the Siberian Platform (Fig. 1): a western belt of restricted-circulation, evaporitic carbonate sediments (Turukhansk-Irkutsk-Olekma facies region), a reef-shoal transitional belt of archaeocyathan-microbial facies (Anabar-Sinian facies region), and an open-marine eastern and northern belt (Judoma-Olenek facies region), (Savitsky and Astashkin, 1979).

In the northeast of the Siberian Platform the best sections comprising the Lower and Middle Cambrian boundary deposits are located near the Kharaulakh Mountains (Lazarenko and Repina, 1983), on the Olenek Uplift (Savitsky *et al.*, 1972) and in outcrops along the Nekekit and Boroulakh rivers (Savitsky and Shalovanov, 1972). The Kharaulakh Mountains and Olenek Uplift sections are assigned to the Anabar-Sinian facies region, and sections along the Nekekit and Boroulakh rivers are assigned to the Judoma-Olenek facies region (Fig. 1).

Inasmuch as across the Lower and Middle Cambrian of the northeastern platform there existed various facies conditions (shallow to deep shelf), the trilobite complexes from here also differ.

KHARAUOLAKH MOUNTAINS TRILOBITE COMPLEXES (FIG. 2)

The most complete section with the Lower and Middle Cambrian boundary deposits containing abundant fauna is near the Kharaulakh Mountains, in the eastern limb of the Burkul anticline. This interval of the section occupies the top part of the Sekten Formation and consists of gray and brown dolomitic and organic-detrital limestones.

The *Paramicmacca* local biostratigraphic zone, corresponding to the Toyonian Stage of the Siberian Platform, is established here in the upper Lower Cambrian. In the top part of this zone the *Meneraspis delicata* beds are recognized. Twenty-four trilobite species are identified from this zone; the most abundant are redlichiids: *Paramicmacca* (six species), *Lermontovia grandis*,

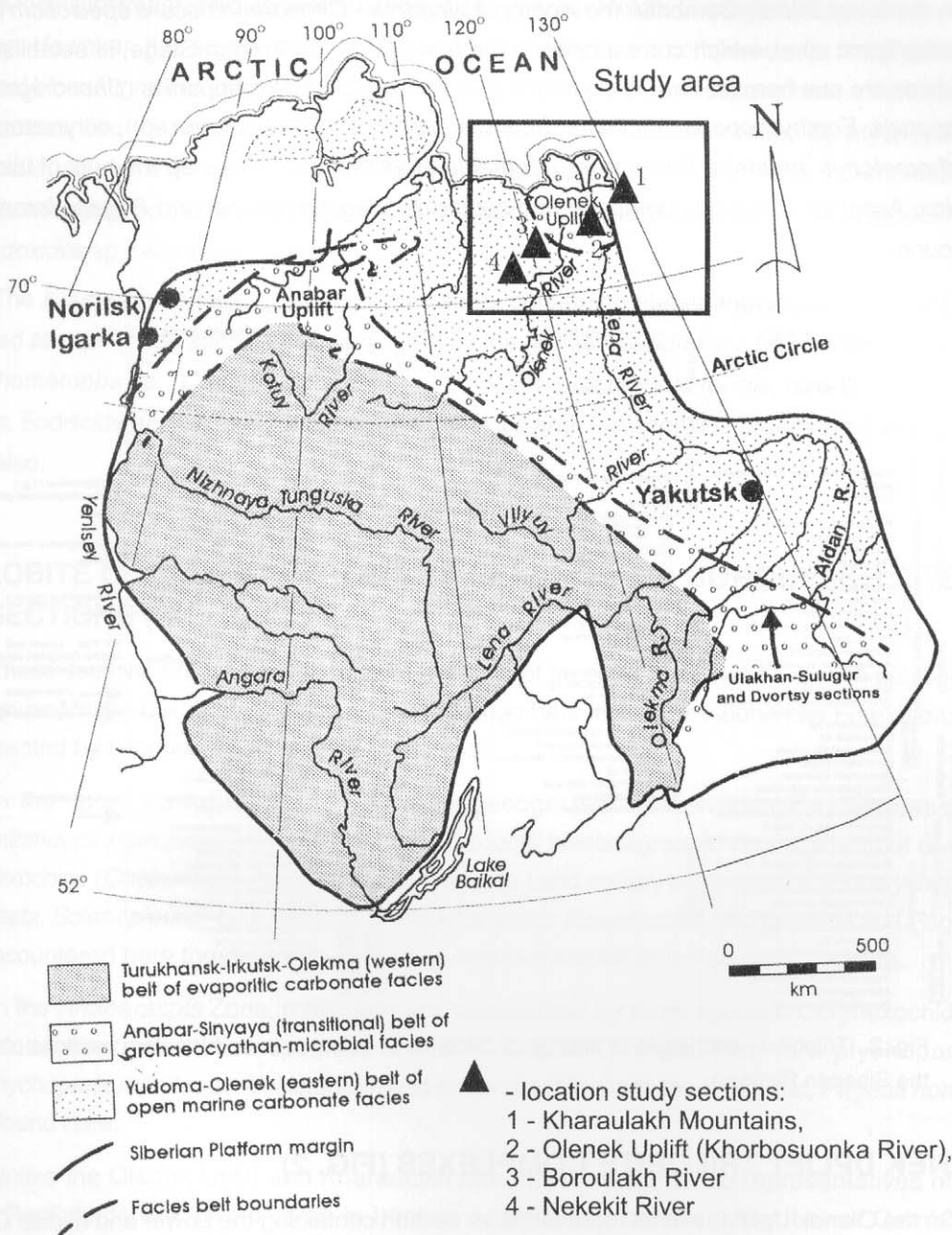


Fig. 1. Map of the Siberian Platform, showing major modern riveres, distribution of major facies belts in late Early and early Middle Cambrian.

Bergeroniellus bellus, *Meneraspis delicata*. Ptychopariids (*Binodaspis*, *Bulkuraspis*), corynexochids (*Edelsteinaspis ornata*, *Kootenia magnaformis*), and eodiscids *Neopagetina* (two species) are less numerous.

In the lower Middle Cambrian the *Kootenia eleganta* - *Chondranomocare speciosum* local biostratigraphic zone, which corresponds to the first half of the Amgan Stage, is established. Redlichiids are rare here (solitary *Anabaraspis* and *Paradoxides*). Ptychopariids (*Chondragraulos minussensis*, *Eopthychoptaria manifesta*, *Alokistocare faseta*, *Solenopleura* sp.), corynexochids (*Dolichometopus perfidelis*, *Dinesus* sp., *Kootenia eleganta*, etc.) make up the bulk of trilobite complex. Asaphids (*Chondranomocare*) and eodiscids (*Pagetia horrida*, and *Pagetia ferox*) are also found.

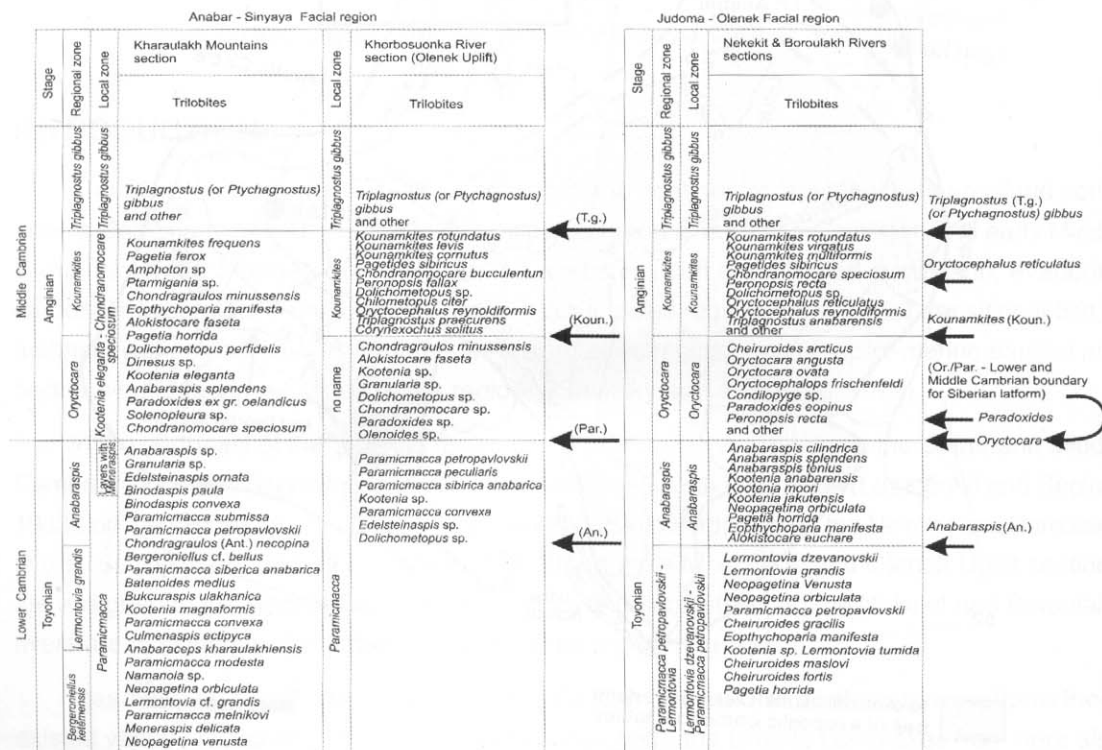


Fig. 2. Trilobites and levels of change of trilobites complexes in northeastern sections of the Siberian Platform.

OLENEK UPLIFT TRILOBITE COMPLEXES (FIG. 2)

On the Olenek Uplift the most representative section containing the Lower and Middle Cambrian boundary is on the Khorbosuonka River. The boundary is established here inside the member of variegated essentially clayey limestones in the top part of the Erkeket Formation.

In the upper Lower Cambrian and near the Kharaulakh Mountains also, the *Paramicmacca* local biostratigraphic zone is distinguished. Despite numerous fragments of fauna from this interval of the section, only seven forms of trilobites were identified. These are various species of the genus *Paramicmacca* (four species). Rare *Kootenia* sp., *Edelsteinaspis* sp., *Dolichometopus* sp. are also encountered.

A local biostratigraphic zone is not recognized in lower Middle Cambrian of the Olenek Uplift section. However, this seven-meter-thick portion of the section is compared with the *Oryctocara* regional biostratigraphic zone on the basis of specific forms of trilobites found here. The fauna of this portion, like that of the Kharaulakh Mountains sections, is dominated by ptychopariids (*Chondragaulos minassensis*, *Alokistocare*) and corynexochids (*Kootenia* sp., *Olenoides* sp., *Dolichometopus* sp.). Representatives of the genus *Chondranomocare*, and Paradoxidids (*Paradoxides* sp.) were also found.

The *Kounamkites* local biostratigraphic zone, containing eleven trilobite species, is distinguished above. These species are dominated by the genus *Kounamkites* and the corynexochids *Dolichometopus* sp., *Chilometopus citer*, *Oryctocephalus reynoldiformis*, and *Corynexochus solitus*. Eodiscids and agnostoids (*Pagetides sibiricus* and *Triplagnostus praecurens*) are present here also.

TRILOBITE COMPLEXES FROM THE NEKEKIT AND BOROULAKH RIVERS SECTIONS (FIG. 2)

These sections are among the best for deposits of an open-shelf in the Siberian paleobasin. The Lower-Middle Cambrian boundary is established here inside the Kuonamka Formation, and represented by bituminous limestones and shales.

In the upper Lower Cambrian there are recognized the *Lermontovia dzevanovskii* - *Paramicmacca petropavlovskii* and *Anabaraspis* local biostratigraphic zones. Rare but diverse corynexochids (*Cheiruroides*, three kinds, *Kootenia* sp.) and solitary ptychopariids (*Eopthychoptaria manifesta*, *Solenopleura?* sp.). Eodiscids and agnostoids *Neopagetina* (two species) and *Pagetia*, are encountered here together with numerous representatives of the order Redlichiida.

In the *Anabaraspis* Zone, redlichiids are represented by three species. Corynexochids of the genus *Kootenia* (three species) are also abundant. In addition, rare ptychopariids (*Eopthychoptaria manifesta*, *Alokistocare*) and eodiscids (*Neopagetina orbiculata*, *Pagetia horrida*) were found here.

Unlike the Olenek Uplift and Kharaulakh Mountains sections, the representatives of the order Redlichiida are less diverse in trilobite complexes from the upper Lower Cambrian. Corynexochids and ptychopariids have come into great importance. Eodiscids and agnostoids are also typical of this interval. Nevertheless, redlichiids are abundant and dominate in trilobite complexes, though their species diversity is low.

The *Oryctocara* local biostratigraphic zone is established in the lower Middle Cambrian. Twenty-three trilobite species were encountered here. Corynexochids make up about half of the species. Of them, oryctocephalids (*Cheiruroides*, *Oryctocara*, *Oryctocephalus*, etc.) are especially abundant. Redlichiids are represented by paradoxidids of the genera *Anabaraspis* (two

species) and *Paradoxides* (three species). Eodiscids and agnostoids are rather representative here: *Peronopsis anabarensis*, *Peronopsis recta*, *Pagetia horrida*, *Pagetia ferox*, *Pagetides sibiricus*, *Pagetides spinisus*, and *Condylopyge* sp.

In upper part of the Nekehit and Boroulakh rivers sections is recognized the *Kounamkites* Zone, which contains more than twenty species of trilobites. Eodiscids and agnostoids (eight species) are most abundant and diverse here. Corynexochids (five species) and ptychopariids (four species) are second to them. Asaphids, *Chondranomocare* (two species), are also encountered.

A distinctive feature of the lower part of the Middle Cambrian section in the Yudoma-Olenek facies region is the dominance of corynexochids (mostly oryctocephalids) in trilobite complexes, and also an abundance of eodiscids and agnostoids. Some species of these orders were widely (virtually globally) distributed in the Middle Cambrian.

THE MAIN LEVELS OF CHANGE OF TRILOBITE COMPLEXES

In the northeastern Siberian Platform, several levels of marked change in trilobite complexes can be recognized in the Lower-Middle Cambrian boundary strata. They are characterized by qualitative changes in taxonomic composition and by the appearance of some forms of trilobites which are widely distributed in the Cambrian of the Siberian Platform and other regions of the world (Fig. 2).

1. The first level is marked by the appearance of paradoxidids (genus *Anabaraspis*) in the section. This level is well traced throughout the platform except for western areas (Turukhansk-Irkutsk-Olekma facies region). At this level, the diversity and quantity of protolenids decreases sharply.

2. This level is characterized by the first appearances of the genera *Paradoxides* and *Oryctocara*. However, it is necessary to note that the genus *Oryctocara* is recognized only in sections of the Yudoma-Olenek facies region. The genus *Paradoxides* is ubiquitous, though in the Yudoma-Olenek facies region it was encountered somewhat (3 m) above the base of *Oryctocara* Zone. This level was officially approved as the Lower-Middle Cambrian boundary for the Siberian Platform (Resolution of the All-Union Stratigraphic workshop, 1983). This level is well distinguished in many regions of the world.

3. The level of occurrence of the genus *Kounamkites* in the section. This genus is well traced in the Yudoma-Olenek and Anabar-Sinian facies regions of the Siberian Platform and is characteristic of the basis of the *Kounamkites* regional biostratigraphic zone.

The level of appearance of *Oryctocephalus indicus* was recently proposed for drawing the boundary between the Lower and Middle Cambrian (Sundberg *et al.*, 1999; Geyer and Shergold,

2000). On the Siberian Platform this species was not found. However, in my opinion, the "Siberian" *Oryctocephalus reticulatus* is its synonym. In open-shelf deposits (Yudoma-Olenek facies region) it occurs in the *Kounamkites* Zone, approximately 9.5 m above the Lower - Middle Cambrian boundary, as officially accepted for the Siberian Platform.

In the Kharaulakh Mountains section, oryctocephalids are absent. On the Olenek Uplift, the Khorbosuonka River section, *Oryctocephalus reynoldiformis* was encountered together with *Oryctocephalus reticulatus* (Savitsky *et al.*, 1972). It is also necessary to note, that some ptychagnostid species of wide paleogeographic distribution make their appearance at this level (Fedoseev, 1998). Thus, this level, though not clearly traceable on the Siberian Platform, probably has a high potential for interregional correlation.

REFERENCES

- FEDOSEEV, A. V., 1999. Characteristics of the distribution of Ptychagnostidae (trilobites) in the Amydai River section of the Amginian Stage (northeastern Siberian platform). *Russian Geology and Geophysics Journal*, **10**: 1389-1402 (In Russian).
- GEYER, G., and J. SHERGOLD, 2000. The quest for internationally recognized divisions of Cambrian time. *Episodes*, **3**: 188-195.
- LAZARENKO, N. P., and L. N. REPINA, 1972. *Lower and Middle Cambrian section of boundary layers from Eastern of Bulkur Anticline*. Novosibirsk, p.22-35 (In Russian).
- Resolution of the All-Union Stratigraphic Workshop on the Precambrian, Paleozoic, and Quaternary of Central Siberia*, 1983. Novosibirsk, Part 1 (In Russian).
- SAVITSKY, V. E., and V. A. ASTASHKIN, 1979. *Role and scales of formation of reeves in Cambrian history of the Siberian Platform*. Novosibirsk, p. 5-18 (In Russian).
- SAVITSKY, V. E., *et al.*, 1972. *Khorbosuonka facies region section*. Novosibirsk, p. 53-60.
- SUNDBERG, F. A. YUAN Jinliang, L. B. McCOLLUM, and ZHAO Yuanlong, 1999. Correlation on the Lower-Middle Cambrian boundary of South China and western United States of America. *Acta Palaeontologica Sinica*, **38**(supplement): 103-107.