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**MICROSCULPTURE STUDY OF LATE PERMIAN
AND EARLY TRIASSIC CONCHOSTRACANS FROM THE BABII
KAMEN SECTION (WESTERN SIBERIA)**

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Abstract

The microsculpture of Permian and Triassic conchostracans from the Babii Kamen section (Western Siberia) was studied in order to determine the significance of microsculpture in the taxonomy of conchostracan species. Five types of ornamentation have been identified in conchostracans from the Permian-Triassic reference section of Western Siberia (Babii Kamen section): pitted, nodular, reticulated, radial lirae, radial fringes. The results show that several microsculpture types are common for the genus level of conchostracans. Transition from one type of ornamentation to another was noted in three species: *?Megasitum lopokolense* Novojilov, 1970, "*Cornia papillaria*" Lutkevich, 1937, and "*Concherisma tomensis*" Novojilov, 1958. The observed changes in the shell microsculpture types can be considered as a taxonomic feature for these three species and should form the base for future taxonomical revisions.

Keywords: Conchostraca, microsculpture, Late Permian, Early Triassic

Introduction

Permian and Triassic conchostracans are widely distributed in continental successions all around the world: they occur on the East European Platform, in Eastern and Western Siberia, Europe, Africa, Asia, Arabia, India, Antarctica, Australia, North and South America. Their use in biostratigraphy has been in focus of many research initiatives [1–5].

Of special interest [1, 6–15] is the shell microsculpture of these small crustaceans – a strengthening skeletal formation of the thin valves with a certain type, or with several types, of ornamentation –, which is a possible diagnostic feature of conchostracan genera and species. The key role of shell microsculpture for conchostracan identification was first stressed by N.I. Novojilov, who described four types of shell ornamentation (fine cellular, large cellular, streaky ribbed, and radial ribbed) [1]. Nevertheless, according to P. Tasch [16], the shell microsculpture is not a sufficient criterion for identification of conchostracan species, because the same species can have different types of shell ornamentation.

To accurately identify the type of ornamentation, one should carefully study the microsculpture on all parts of the shell: at the umbo, in the central part of the valve, as well as at the anterior, ventral, posterior, and dorsal margins. It is noteworthy that the microsculpture is smaller at the anterior and posterior margins, because the width of growth bands in these parts of the shell is smaller.

Materials and Methods

The Babii Kamen section is located in the Kuznetsk coal basin (Kemerovo region, Western Siberia) on the right bank of the Tom River, 45 km downstream from Novokuznetsk. The section is represented by Permian coal-bearing sediments covered by Triassic volcanogenic-terrigenous rocks.

The section is divided into the Tailugan and Maltsevo formations (Fm.). The Tailugan Fm. is determined as Permian, while the Maltsevo Fm. as Triassic. The Maltsevo Fm. consists of the Tarakanikha, Barsuchii, Kedrovii, and Ryaboi Kamen members (Mb.).

Fossil remains in the Babii Kamen section are represented by ostracods, conchostracans, insects, gastropods, bivalve mollusks, fish scales, and terrestrial plants.

Conchostracans were sampled from the Babii Kamen section (in the upper layers of the Tailugan Fm. and Tarakanikha Mb., Kedrovii Mb., and Ryaboi Kamen Mb. of the Maltsevo Fm.) during 2015–2018.

The microsculpture of conchostracan shells was examined under a VEGA\TESCAN scanning electron microscope. The drawings of conchostracan valves were made using a Leica stereomicroscope equipped with a mirror tube.

The types of conchostracan microsculptural ornamentation from the Babii Kamen section were determined using the methodology of conchostracan identification proposed by F. Scholze and J.W. Schneider [12].

The material is stored at the Geological Museum of Kazan Federal University (nos. 39/BK15, 39/BK16, and 39/BK18).

The description distinguishes the following main types of shell microstructure in conchostracans [12]: smooth, pitted, nodular, reticulated, radial reticulated, radial lirae, radial fringes. A smooth microsculpture means the absence of any ornamentation. The pitted type of ornamentation is built up by circular dimples on the valves. Rounded tubercles on the valves characterize the nodular microsculpture. Polygonal dimples on the valves is a feature of reticulated ornamentation. Ornamentation with lines perpendicular to the growth lines is attributed to the radial reticulated type. The radial lirae microsculpture typically features lines on the growth bands. A branched linear ornamentation with lines perpendicular to the growth bands is characteristic for the radial fringes type.

Results

The sampled conchostracans are tentatively assigned to seven genera: *Pseudestheria* Raymond, 1946, *Cornia* Lutkevich, 1938, *Megasitum* Novojilov, 1970, *Echinolimnadia* Novojilov, 1965, *Concherisma* Novojilov et Varentsov, 1956, *Euestheria* Depéret and Mazeran, 1912, and *Hemicycloleaia* Raymond, 1946.

Pseudestheria Raymond, 1946 is characterized by oval shells with unequal anterior and posterior heights. This genus belongs to the family Lioestheriidae Raymond, 1946. *P. novacastrensis* (Mitchell, 1927) occurs in the Tarakanikha Mb. and Kedrovii Mb. of the Babii Kamen section [18]. The species has a pitted type of shell microsculpture (Fig. 1). Reticulated microsculpture is typical for the shells of *P. exigua* (Eichwald, 1860) from the Monastery Ravine section and *P. cf. itiliana* (Novojilov, 1950) from the Cheremushka Ravine section in Tatarstan.

Cornia Lutkevich, 1938 is characterized by a narrow spine on the larval valve. This genus belongs to the family Vertexiidae Kobayashi, 1954 [4, 17]. A specimen identified as "*C. papillaria*" Lutkevich, 1937 was found in the Kedrovii Mb. of the Maltsevo Fm. in the Babii Kamen section [18]. The shell microsculpture of this species varies in different areas: the transition from reticulated ornamentation to radial fringes is visible on the growth bands of the shell (Fig. 1).

A droplet-shaped structure on the larval valve is the main characteristic for *Megasitum* Novojilov, 1970. Specimens similar to two species of this genus – *M. lopokolense* Novojilov, 1970 and *M. harmonicum* Novojilov, 1970 were found in the Kedrovii Mb. of the Maltsevo Fm. [18]. Shell microsculpture types differ for these two species. Three different types of ornamentation were observed on the shell of ?*M. lopokolense*: pitted microsculpture at the umbo; radial fringes and reticulated microsculptures on the middle and ventral parts of the valve (Fig. 2). The microsculpture of ?*M. harmonicum* is on the inner side of the valve. Almost all specimens have badly preserved ornamentation on the outer side of the valve. Pitted ornamentation was observed on the valves of this species (Fig. 2).

Echinolimnadia Novojilov, 1965 is characterized by rounded, truncated valves with several radial rows of spikes. The specimens sampled from the Kedrovii Mb. and Ryaboi Kamen Mb. of the Maltsevo Fm. resemble *E. mattoxi* Novojilov, 1965 [18]. Reticulated ornamentation of the shell is characteristic for this species [19].

Specimens similar to *Concherisma tomensis* Novojilov, 1958 were found in the Kedrovii Mb. of the Maltsevo Fm. [18]. The reticulated microsculpture runs to the radial lirae at the anterior-ventral margin on the valves of this species. Some specimens of "*C. tomensis*" had pitted ornamentations (Fig. 3).

The species *Euestheria gutta* (Lutkevich, 1938) was registered in the Kedrovii Mb. and Ryaboi Kamen Mb. in the Babii Kamen section. This species is an indicator of the Lower Triassic [4, 18, 20] and has a fine pitted shell microsculpture (Fig. 3).

Hemicycloleaia Raymond, 1946 has three radial ribs on the valve. This genus is part of the family Leaiidae Raymond, 1946 [17]. "*Hemicycloleaia*" specimens were sampled in the Kedrovii Mb. of the Maltsevo Fm. Preliminarily, three types of ornamentation were observed on their valves: reticulated microsculpture at the umbo; radial reticulated microsculpture in the middle part of the valve; and nodular ornamentation near the ventral margin (Fig. 3).

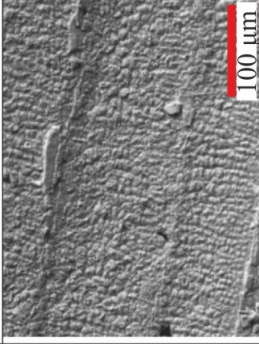
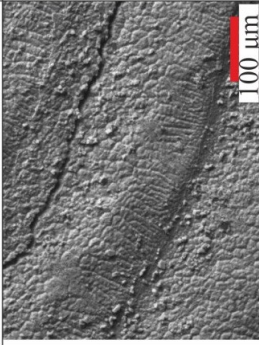
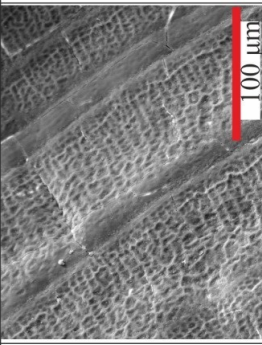
Radial fringes		
Reticulated		
Pitted		
	<p><i>Pseudestheria novacastrensis</i></p>	<p>“<i>Cornia papillaria</i>”</p>

Fig. 1. Types of microsculpture on conchostracan shells from the Babii Kamen section. *Pseudestheria novacastrensis* – pitted type; “*Cornia papillaria*” – transition from reticulated type near the umbo to radial fringes ornamentation on the growth bands

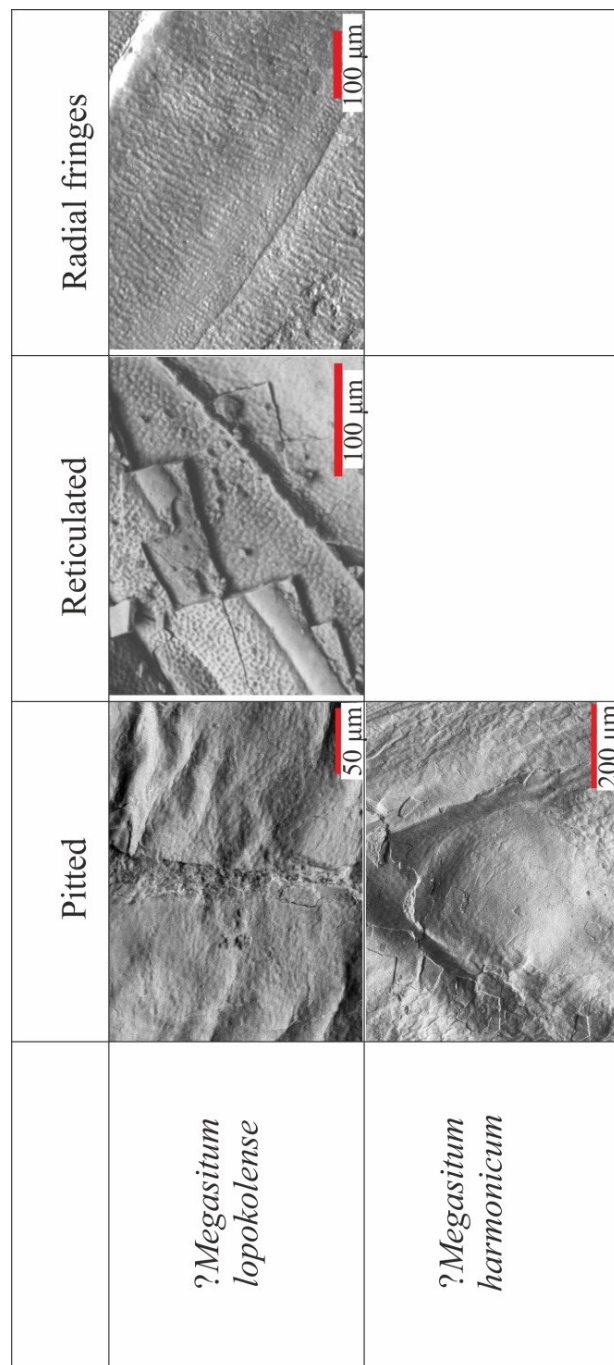


Fig. 2. Types of shell microsculpture on conchostracan shells from the Babii Kamen section. *?Megasitum lopokolense* – pitted, reticulated, radial fringes types; *?Megasitum harmonicum* – pitted type.

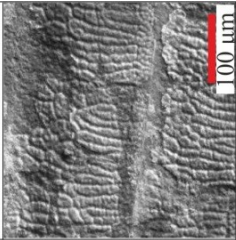
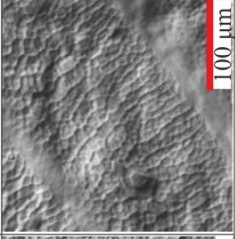
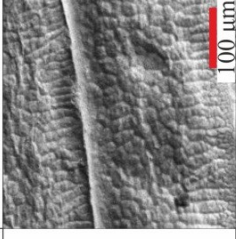
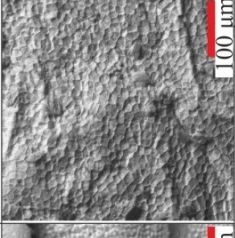
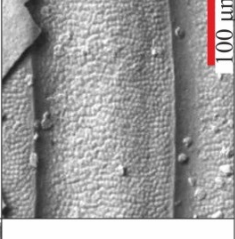
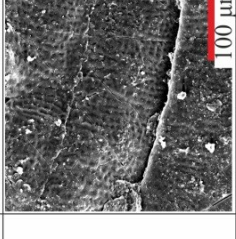
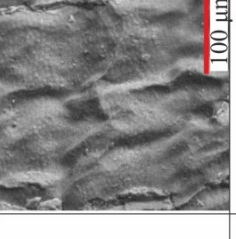
Radial lirae			
Radial fringes			
Reticulated			
Nodular			
Pitted			
	<i>“Concherisma tomensis”</i>	<i>Euestheria gutta</i>	<i>“Hemicycloleia”</i> sp.

Fig. 3. Types of shell microsculpture on conchostracan shells from the Babii Kamen section. *“Concherisma tomensis”* – transition from reticulated to radial lirae type near the antero-ventral margin. Some specimens have pitted ornamentation; *Euestheria gutta* – fine pitted type; *“Hemicycloleia”* sp. – transition from reticulated type at the umbo to radial reticulated type in the middle part of the valve and nodular type near the ventral margin

Conclusions

Shell microsculptures have been studied in several Late Permian and Early Triassic conchostracan taxa from Babii Kamen section in Western Siberia. Fossils tentatively attributed to the genera *Cornia*, *Megasitum*, and *Concherisma* (“*Cornia papillaria*”, ?*Megasitum lopokolense* and “*Concherisma tomensis*”) exhibit several types of ornamentation, suggesting that these forms might be characterized rather by a combination of microsculptures than by a single type. The taxonomic significance of such transitions from one ornamentation type to another, as well as their possible interpretation as indicative for changes of environmental conditions, remains to be explored in upcoming works.

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**Микроскульптурные исследования позднепермских
и раннетриасовых конхострак из разреза Бабий Камень (Западная Сибирь)**

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Аннотация

Изучена микроскульптура пермских и триасовых конхострак из разреза Бабий Камень (Западная Сибирь) с целью установления значимости данного признака при определении видовой принадлежности конхострак. Выявлено и описано пять типов микроскульптурного орнамента конхострак: ячеистая, бугорчатая, сотовидная, линейная, линейно-разветвленная. Результаты исследования показывают, что несколько типов микроскульптурного орнамента могут являться одной из характеристик для родов *Cornia*, *Megasitum* и *Concherisma*. Переход от одного типа орнамента к другому характерен для трех видов: *Megasitum lopokolense* Novojilov, 1970, "*Cornia papillaria*" Lutkevich, 1937 и "*Concherisma tomensis*" Novojilov, 1958. Изменения типов микроскульптурного орнамента можно считать таксономической особенностью этих трех видов.

Ключевые слова: конхостраки, микроскульптура, поздняя пермь, ранний триас

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