

UDC 57.07

doi: 10.26907/2542-064X.2020.2.244-252

**EARLY TRIASSIC CONCHOSTRACANS FROM THE TIRYAKH-KOBYUME SECTION (SOUTHERN VERKHUYANSK REGION, REPUBLIC OF SAKHA (YAKUTIA))**

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**Abstract**

Conchostracans (Crustacea) from the Induan deposits of the Tiryakh-Kobyume section (southern Verkhoyansk region) were studied. We identified the following seven conchostracan species belonging to five genera: *Pseudestheria* Raymond, 1946; *Euestheria* Deperet et Mezeran, 1912; *Sphaerestheria* Novojilov, 1954; *Lioestheria* Deperet et Mezeran, 1912; *Wetlugites* Novojilov, 1958. Most of the previously identified species in the Tiryakh-Kobyume region (“*Pseudestheria sibirica*”, “*Ps. tumaryana*”, “*Ps. kashirtzevi*”, and “*Sphaerestheria aldanensis*”) were described in the middle of the 20th century from the basal Triassic in the western Verkhoyansk region (Balbuk section). Revision of these species with the use of modern methods of conchostracan classification is needed.

**Keywords:** conchostracans, Early Triassic, southern Verkhoyansk region

**Introduction**

Modern conchostracans are small crustaceans with a bivalved carapace. They are geographically widespread and inhabit continental ephemeral low-energy water basins (ponds, lakes, or puddles). Their eggs are microscopic in size (130–350 µm) and easily transported over long distances by wind, water currents, or animals (birds, fish, amphibians, and insects). In extreme environments, conchostracan eggs may quickly enter into an anabiotic state.

Because of both the wide distribution and the tenacity to harsh environments, fossil conchostracans are considered as one of the best suited faunal elements for biostratigraphic correlations in continental settings. Some Permian and Triassic species are interregionally distributed with narrow stratigraphic ranges [1–3].

Previously, conchostracans have been sampled only occasionally in the study region, without any systematic investigation [4, 5]. A new collection of conchostracans was obtained from the Early Triassic (Induan) marine deposits of the Tiryakh-Kobyume section in the southern Verkhoyansk region, Russia (Fig. 1). We hope that our study will add to the knowledge of the faunal composition of these Induan deposits in the southern Verkhoyansk region and clarify the stratigraphic ranges of certain conchostracan species.

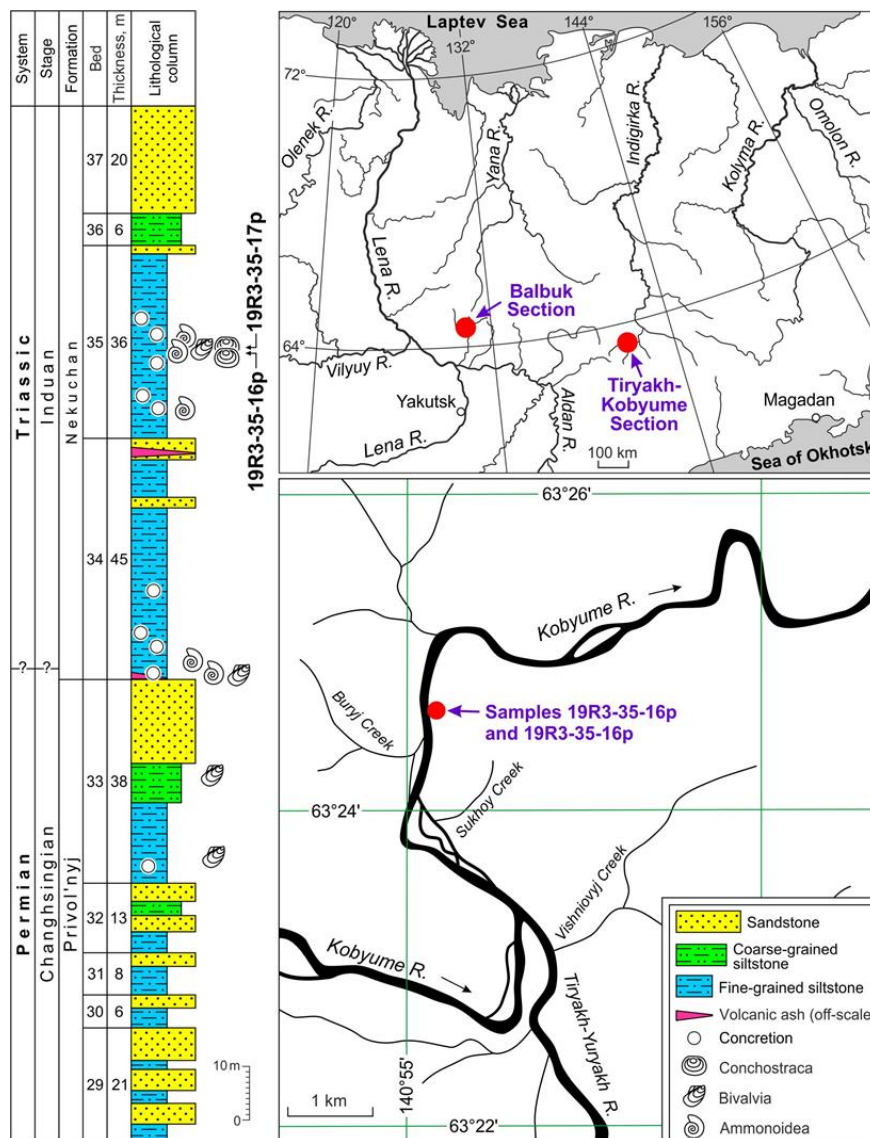


Fig. 1. Findings of the Induan conchostracans in the Verkhoyansk region; the Permian-Triassic boundary interval of the Tiryakh-Kobyume section with occurrences of conchostracans, ammonoids, and bivalves; the location of the Tiryakh-Kobyume (new findings of conchostracans) and Balbuk (conchostracans were collected by A.S. Kashirtsev in 1951 [6]) sections in Eastern Siberia; and the occurrence of conchostracans near the Kobyume River (Tiryakh-Kobyume section)

### Materials and Methods

The Permian and Triassic Tiryakh-Kobyume section, which is over 3000 m thick, is located near the mouth of the Tiryakh-Yuryakh River, the right tributary of the Kobyume River in the southern Verkhoyansk region, and along the Kobume River (Republic of Sakha (Yakutia)) (Fig. 1). The types of the middle-upper Permian formations in the region for all formations of the Permian system of the Kobyume sub-basin occur in this section [7]. The upper part of the Tiryakh-Kobyume section consists

of the Permian Privol'nyj Formation (about 600 m thick) and the Triassic Nekuchan Formation (500 m thick). The outcrop of the lower part of the Nekuchan Formation was studied on the right bank of the Kobyume River, 2.5 km downstream of the mouth of the Tiryakh-Yuryakh River [8] (Fig. 1).

The lower part of the Nekuchan Formation is composed of siltstone with rare interlayers of fine- to medium-grained sandstones and numerous silty carbonate concretions (Fig. 1).

The base of bed no. 34 in our stratigraphic log marks the lower unit of the Nekuchan Formation. A potential volcanic tuff was found at the base of bed no. 34. The *Otoceras* ammonoids occur in bed no. 34 [8]. This genus is a biostratigraphic indicator of the latest Permian to early Triassic age in both northern Pangea and peri-Gondwana. The occurrence of *Otoceras boreale* Spath demarcates the Permian-Triassic boundary in the section, which is 2.5 m above base bed no. 34. Along with conchostracans and bivalves, ammonoids of the genus *Tompophiceras* sampled from silty carbonate concretions in bed no. 35 indicate the Induan age.

In the studied section, about 150 conchostracan specimens were obtained from bed no. 35 during the field work in 2019. Some conchostracan shells are well-preserved with shell substance. Their size ranges from small to medium (total valve length of 1.84–3.9 mm).

Conchostracans were studied using a Zeiss Discovery V8 microscope equipped with a digital camera and the Zeiss Axio Vision software. They were taxonomically identified with the help of modern methodology of their classification [9], which is based on measurement of the main parameters of conchostracan shells (size and shape of the conchostracan valve in lateral view, length of the dorsal margin, position of the umbo in the horizontal and vertical directions, size of the larval valves, as well as positions of maximal curvatures at the anterior, posterior, and dorsal margins).

### Results and Discussion

The conchostracan assemblage under study includes the following seven species: “*Pseudestheria sibirica*” Novojilov, 1959; “*Ps. tumaryana*” Novojilov, 1959; “*Ps. kashirtzevi*” Novojilov, 1959; “*Sphaerestheria aldanensis*” Novojilov, 1959; “*Lioestheria ignatjevi*” Novojilov, 1959; *Wetlugites pronus* Novojilov, 1958; *Euestheria gutta* (Lutkevich, 1938). These species are shown in Figs. 2 and 3. The “quotation marks” indicate questionable taxonomy of the identified species [10], as discussed below.

Holotypes and paratypes of four species (“*Ps. sibirica*”, “*Ps. tumaryana*”, “*Ps. kashirtzevi*”, “*Sph. aldanensis*”) were collected by A.S. Kashirtsev in 1951 on the Balbuk River (the right tributary of the Tumara River, Aldan River basin, western Verkhoyansk region), which is located 18 km upstream of the river mouth, in the Early Triassic deposits. These species were first described by N.I. Novojilov [11, 12]. However, their taxonomy should be revised with the help of more advanced methods (biometry, microsculptures, etc.) [9]. The above mentioned species are widespread in the Induan and Olenekian deposits in the northern part of Yakutia, Induan deposits of the Volga region, and in the Pechora coal basin [11–13]. Notably, V.A. Molin and N.I. Novojilov [11] registered “*Ps. sibirica*” and “*Sph. aldanensis*” in the Triassic

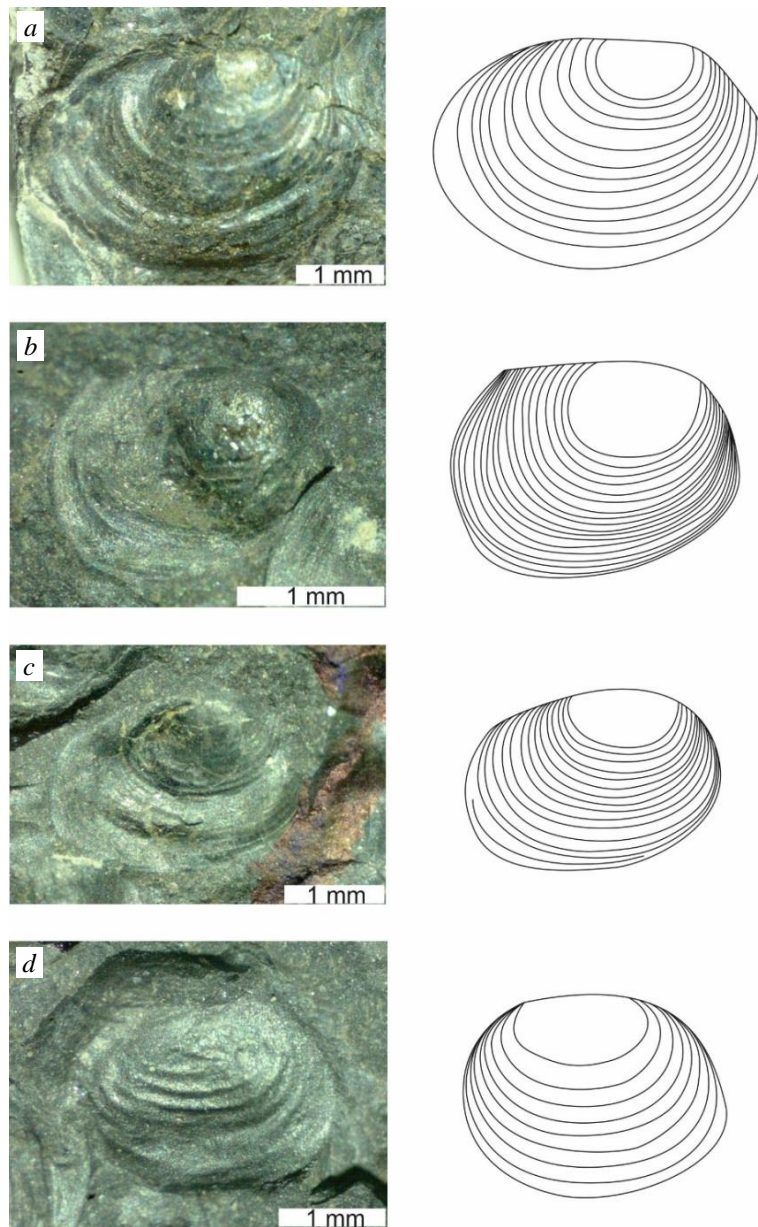


Fig. 2. Conchostracans from the Early Triassic deposits in the Tiryakh-Kobyume section (bed no. 35). a) "*Pseudestheria sibirica*" Novojilov, 1959 with elongated shape and small larval valves. b) "*Pseudestheria tumaryana*" Novojilov, 1959 with short valves and small larval valves. c) "*Pseudestheria kashirtzevi*" Novojilov, 1959 with short valves and rounded larval valves. d) "*Sphaerestheria aldanensis*" Novojilov, 1959 with short rounded valves and small larval valves. According to literature data, these species have similar size and taxonomic characteristics [11, 12]. It is necessary to revise them

deposits of the Kobyume River basin. Unfortunately, the precise localities of these findings are unknown. Previously, "*Ps. kashirtzevi*" and "*Ps. sibirica*" were also found in the Induan deposits of the Pechora coal basin [13].

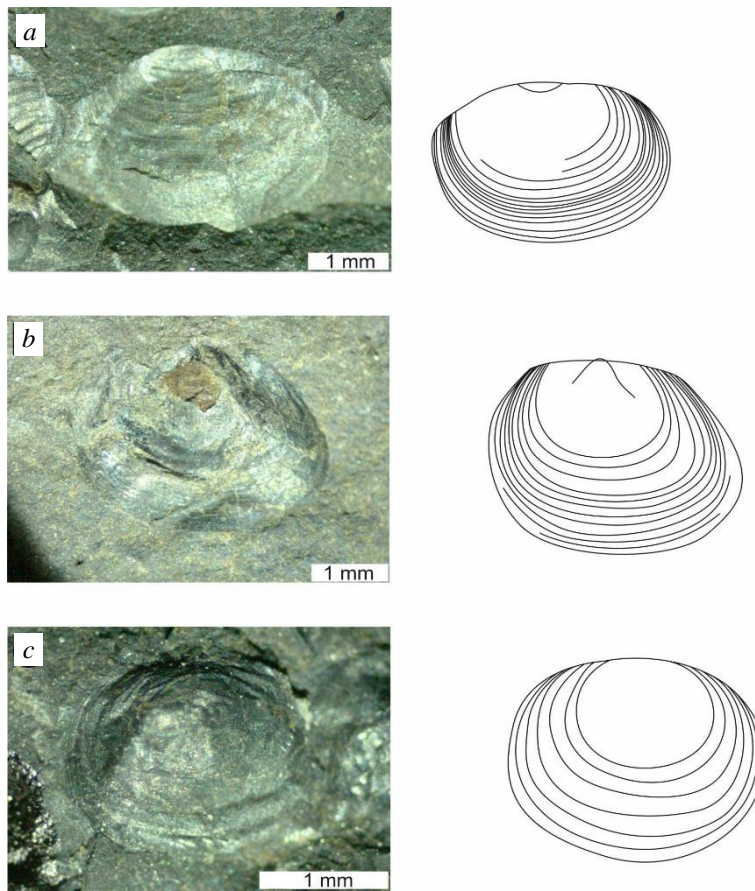


Fig. 3. Conchostracans from the Early Triassic deposits in the Tiryakh-Kobyume section (bed no. 35). *a*) “*Lioestheria ignatjevi*” Novojilov, 1959 with short valves and a supramarginal, submedial umbo. *b*) *Wetlugites pronus* Novojilov, 1958 with elongated valves and a large larval valve with well-preserved umbo. *c*) *Euestheria gutta* (Lutkevich, 1938) with a rounded shape and a supramarginal, medial position of the umbo

“*L. ignatjevi*” is known from the Early Triassic sediments (Induan stage) of the Volga region, South Urals, and northern Yakutia [11]. The holotype of this species was collected from the Induan deposits (Ryabinsky horizon) in the Volga region, the Vetluga basin [11, 12].

*W. pronus* occurs in the Early Triassic (Induan) sediments in the Volga region and in the northern part of Yakutia. The findings of this species were also reported from the Early Triassic sediments of the Kobyume River basin [11]. The holotype of *W. pronus* was sampled in the Induan deposits along the Vyatka River (Volga basin), 3 km northward of the village of Putyatino [11, 12].

The occurrence of *E. gutta* in the southern Verkhoyansk region is important for biostratigraphy. This species is widespread in the Induan and Olenekian deposits in the northern part of Yakutia, as well as in the Induan deposits of both the Volga region and the Pechora basin [13]. Recently, we have found *E. gutta* in the Early Triassic deposits (Barsuchi Member of the Maltsevo Formation) of the Babyi Kamen section (Kuznetsk coal basin) [14] and in the Induan deposits of the Pechora basin [13].



The holotype of this species was obtained from the Induan deposits near the Tsilma River, 1.5–2 km downstream of the mouth of the Myla River in European Russia [11, 15, 16].

### Conclusions

The conchostracan assemblage in the Tiryakh-Kobyume section comprises several species characterized by wide palaeogeographic distribution and narrow stratigraphic ranges. For biostratigraphy, it is essential to study conchostracans from this section because of their association with the Early Induan ammonoids. The taxonomic validity of “*Ps. sibirica*”, “*Ps. tumaryana*”, “*Ps. kashirtzevi*”, and “*Sph. aldanensis*” must be revised with the use of modern methods and equipment.

**Acknowledgments.** We thank A.N. Kilyasov and I.V. Budnikov for their assistance during the sampling procedures and description of the section.

The study was supported by the subsidy allocated to Kazan Federal University for the state assignment no. 671-2020-0049 in the sphere of scientific activities. The conchostracan study was funded by the Russian Science Foundation (project no. 19-17-00178).

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Received  
May 15, 2020

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УДК 57.07

doi: 10.26907/2542-064X.2020.2.244-252

**Раннетриасовые конхостраки из разреза Тирях-Кобюме  
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г. Якутск, 677007, Россия**Аннотация**

Статья посвящена изучению конхострак (Crustacea) из индских отложений разреза Тирях-Кобюме. Определены семь видов конхострак, относящихся к пяти родам: *Pseudestheria* Raymond, 1946; *Euestheria* Deperet et Mezeran, 1912; *Sphaerestheria* Novojilov, 1954; *Lioestheria* Deperet et Mezeran, 1912; *Wetlugites* Novojilov, 1958. Большинство видов, выявленных в разрезе Тирях-Кобюме ("*Ps. sibirica*", "*Ps. tumaryana*", "*Ps. kashirtzevi*", "*Sph. aldanensis*"), были описаны в середине прошлого века из триасовых отложений Западного Верхоянья (разрез Балбук). Необходимо провести ревизию этих видов на основе современной методики классификации конхострак.

**Ключевые слова:** конхостраки, ранний триас, Южное Верхоянье

**Благодарность.** Авторы выражают благодарность своим коллегам А.Н. Килясову и И.В. Будникову за помощь в сборе образцов и описании разреза.

Работа поддержана субсидией, выделенной Казанскому федеральному университету по государственному заданию № 671-2020-0049 в сфере научной деятельности и грантом Российского научного фонда № 19-17-00178.

Поступила в редакцию  
15.05.2020

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**For citation:** Zharinova V.V., Scholze F., Davydov V.I., Kutygin R.V. Early Triassic conchostracans from the Tiryakh-Kobyume section (southern Verkhoyansk region, Republic of Sakha (Yakutia)). *Uchenye Zapiski Kazanskogo Universiteta. Seriya Estestvennye Nauki*, 2020, vol. 162, no. 2, pp. 244–252. doi: 10.26907/2542-064X.2020.2.244-252.

**Для цитирования:** Zharinova V.V., Scholze F., Davydov V.I., Kutygin R.V. Early Triassic conchostracans from the Tiryakh-Kobyume section (southern Verkhoyansk region, Republic of Sakha (Yakutia)) // Учен. зап. Казан. ун-та. Сер. Естеств. науки. – 2020. – Т. 162, кн. 2. – С. 244–252. – doi: 10.26907/2542-064X.2020.2.244-252.