

UDC 57.07

doi: 10.26907/2542-064X.2019.2.339-347

LATE PERMIAN AND EARLY TRIASSIC CONCHOSTRACANS FROM THE BABII KAMEN SECTION (KUZNETSK COAL BASIN)

V.I. Davydov^a, V.V. Zharinova^b, V.V. Silantiev^b

^aBoise State University, Boise, 1910 USA

^bKazan Federal University, Kazan, 420008 Russia

Abstract

The Late Permian and Early Triassic conchostracans from the Babii Kamen section (Western Siberia) were studied. The conchostracans were collected from the section during the field work in 2015–2018. It was found that the conchostracans from the Babii Kamen section are characterized by a rather high taxonomical diversity: we identified five Late Permian conchostracan species (*Pseudestheria novacastrensis* (Mitchell, 1927), *Cornia papillaria* (Lutkevich, 1937), *Megasitum harmonicum* Novojilov, 1970, *Megasitum lopokolense* Novojilov, 1970, and *Echinolimnadia mattoxi* Novojilov, 1965) and two Early Triassic species (*Concherisma tomensis* Novojilov, 1958, *Cyclotunguzites gutta* (Lutkevich, 1938)). The discovered conchostracan species occur frequently in the Permian and Triassic sections of other regions and are useful for regional biostratigraphy and interregional correlation.

Keywords: Conchostraca, Late Permian, Early Triassic, biostratigraphy

Introduction

Conchostracans – small ephemeral crustaceans with a bivalved carapace – represent one of the most promising groups for biostratigraphy of continental deposits. Their important ability is to quickly increase the population size. Conchostracan eggs sustain extreme environmental conditions (such as cold, drought, etc.), quickly shift from biological activity to an anabiotic state, and tolerate it for a long time.

Conchostracans are widespread in continental deposits all around the world. Some species have a narrow stratigraphic range, thereby being the promising objects for regional biostratigraphy and interregional correlation. We sampled a large collection of conchostracans in the Babii Kamen section, the type section of the Permian–Triassic transition in the Kuznetsk coal basin and surrounding regions. Many scientists have studied the Babii Kamen section, but the Permian and Triassic boundary of this section has not been accurately established. This study aims at clarifying the position of the Permian–Triassic transition with the help of conchostracans.

Materials and Methods

The Babii Kamen section (N 54.385225; E 87.534854) is located in the Kuznetsk coal basin on the right bank of the Tom River, 45 km downstream from Novokuznetsk. The Permian–Triassic transition in this section consists of the Permian

Tailugan and Triassic Maltsevo formations (Fm.). V.T. Belousova and G.P. Radchenko [1, 2] divided the Maltsevo Fm. into the Tarakanikha, Barsuchii, Kedrovii, and Ryaboi Kamen members (Mb.).

The Tailugan Fm. comprises cyclic interbedding of argillites, siltstones, sandstones, and coal beds. The deposits of the Maltsevo Fm. are represented by mixed siliciclastic-volcanoclastic rocks. Basalt layers of up to 14 m lie in the upper part of the section (Ryaboi Kamen Mb.). Numerous fossil remains occur in this section, such as ostracods, conchostracans, insects, gastropods and bivalves, fish scales, and terrestrial plants.

Conchostracans were collected in the Babii Kamen section during field work in 2015–2018. About 500 conchostracan specimens were obtained from 12 stratigraphic layers. The specimens used in the study were found in the upper layers of the Tailugan Fm., as well as in the Tarakanikha Mb., Kedrovii Mb., and Ryaboi Kamen Mb. of the Maltsevo Fm. (Fig. 1).

Conchostracan shells are well preserved. Their size ranges from small to large (2.5–5.8 mm). Most specimens have concentric ribs on the valves and many of them possessed shell substance.

During the microscopic study of the conchostracan specimens, we made photos using a digital ocular Zeiss DiscoveryV8 and a special software application Zeiss Axio Vision. The drawings of the shells were made by using the Leica microscope equipped with a mirror tube.

The morphology of the valves was studied based on the updated conchostracan classification and identification method [3]. This identification method included the determination of size and shape of conchostracan shells, length of dorsal margin, position of the umbo in the horizontal and vertical directions, size of the larval valves, as well as maximal curvatures at the anterior, posterior, and dorsal margins.

The studied material is stored at the Geological Museum of Kazan Federal University under the inventory numbers 39/BK15 and 39/BK16.

Results and Discussion

The distribution of the identified species from the Babii Kamen section represented by the Permian and Triassic forms is shown in Fig. 1. The Permian species *Pseudestheria novacastrensis* (Mitchell, 1927) was found 100 m below the last coal layer in this section within the Tailugan Fm. and in the Tarakanikha Mb. and Kedrovii Mb. of the Maltsevo Fm. (Fig. 1) [4].

The highest species diversity of conchostracans was recorded in the upper part of the Maltsevo Fm. (upper 115 m): *Cornia papillaria* Lutkevich, 1937; *Megasitum harmonicum* Novojilov, 1970; *Megasitum lopokolense* Novojilov, 1970; *Echinolimnadia mattoxi* Novojilov, 1965; *Concherisma tomensis* Novojilov, 1958; *Cyclo-tunguzites gutta* (Lutkevich, 1938).

P. novacastrensis was originally described from the Belmont beds of the Upper Permian in the Sydney coal basin, Australia [5, 6]. This species has a truncated valve with a supramarginal position of the umbo (Fig. 2, A). The characteristic feature of this species is a huge morphological variability within the population. In Russia, this species is known from the Upper Permian deposits of the Siberian Platform (Yenisei River, Nizhnyaya Tunguska River), East European Platform, Pechora Basin [7].

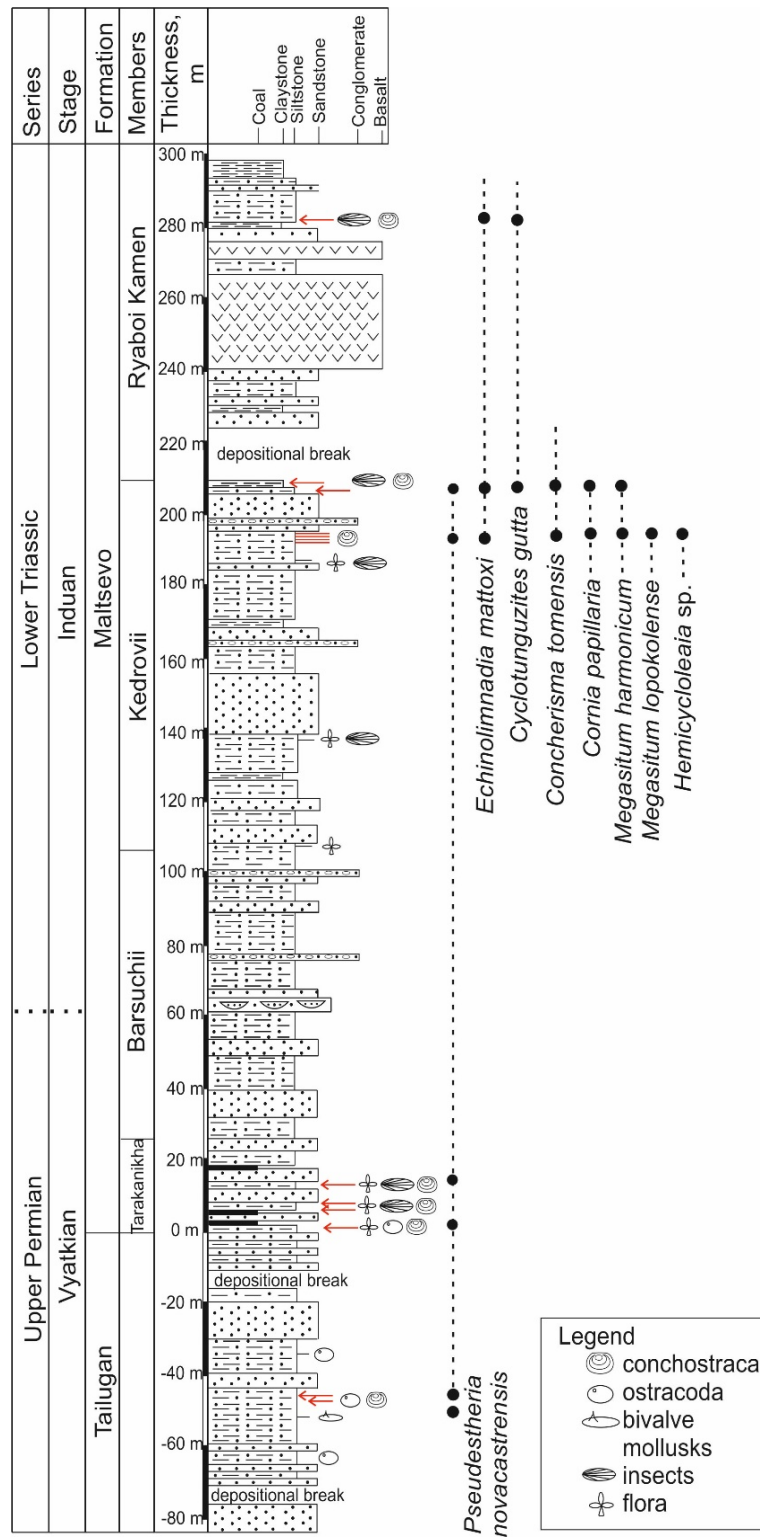


Fig. 1. The lithological and stratigraphic profiles of the Babii Kamen section with the appearance levels of conchostracans, ostracods, bivalves, insects, and floral elements

The rare specimens of *C. papillaria* Lutkevich, 1937 occur in the Kedrovii Mb. of the Maltsevo Fm. This species is characterized by the presence of a narrow spine on the larval valve (Fig. 2, B). The Babii Kamen section is the topotype of this species. Notably, *C. papillaria* and is the type species of genus *Cornia* Lutkevich, 1937. The species was early reported from the Upper Permian Vyatkian stage in the Babii Kamen section [8, 9, 10]. The genus *Cornia* is abundant from the Carboniferous to Lower Triassic [9, 11].

M. harmonicum Novojilov, 1970 and *Megasitum lopokolense* Novojilov, 1970 were found in the Kedrovii Mb. of the Maltsevo Fm. The great cone is the main distinction of the genus *Megasitum* Novojilov, 1970. *M. harmonicum* has larger larval valves than *M. lopokolense*. The cone of *M. harmonicum* is elongated (Fig. 2, C), while the cone of *M. lopokolense* is rounded (Fig. 2, D). These species and the genus *Megasitum* have been described from the Upper Permian (Severodvinian and Vyatkian stages) deposits in the Nizhnyaya Tunguska River basin [9].

A few specimens of *E. mattoxi* Novojilov, 1965 were found in the Kedrovii Mb. of the Maltsevo Fm. The mass occurrence of this species was documented in the Ryaboi Kamen Mb. of the Maltsevo Fm. The genus *Echinolimnadia* Novojilov, 1965 is characterized by rounded, truncated valves with several radial rows of spikes (Fig. 3, A). The only species of this genus – *E. mattoxi* Novojilov, 1965 was described from the Vyatkian sediments of the Nizhnyaya Tunguska River basin and Kuzbass [9, 12, 10].

C. tomensis Novojilov, 1958 occurs in the Kedrovii Mb. of the Maltsevo Fm. Oblong valves with overhanging growth lines along the anterior margin is the main characteristic feature of this species (Fig. 3, B). *C. tomensis* is known from the Lower Triassic deposits of Kuzbass and Taimyr only [8, 9].

For biostratigraphy of the region, it is essential to identify *C. gutta* (Lutkevich, 1938) in the Kedrovii and Ryaboi Kamen Mbs. This species is characterized by rounded valves with a supramarginal position of the umbo (Fig. 3, C) and known only from the Lower Triassic sediments in the Moscow syncline, Pechora Basin, Tunguska Basin in Siberia, and North China [8, 13, 14].

Conchostracans of the genus *Hemicycloleaia* Raymond, 1946 sampled in the Kedrovii Mb. of the Maltsevo Fm were rare. The genus is characterized by the presence of three radial ribs on the valve. The discovered in the Babii Kamen section specimens have radial ribs ending in the middle of the valve (Fig. 3, D). The genus is known from the Lower and Upper Permian deposits of Urals, Siberia, Australia, and Brazil [11].

Conclusions

Thanks to the conchostracans, it was possible to establish the Permian–Triassic boundary in the Babii Kamen section. The appearance of the identified conchostracan species in other regions enables further correlations with other sections.

Among the identified conchostracan species, *C. tomensis* and *C. gutta* should be considered as the indicators of the Lower Triassic sediments in the Kuznetsk Coal Basin.

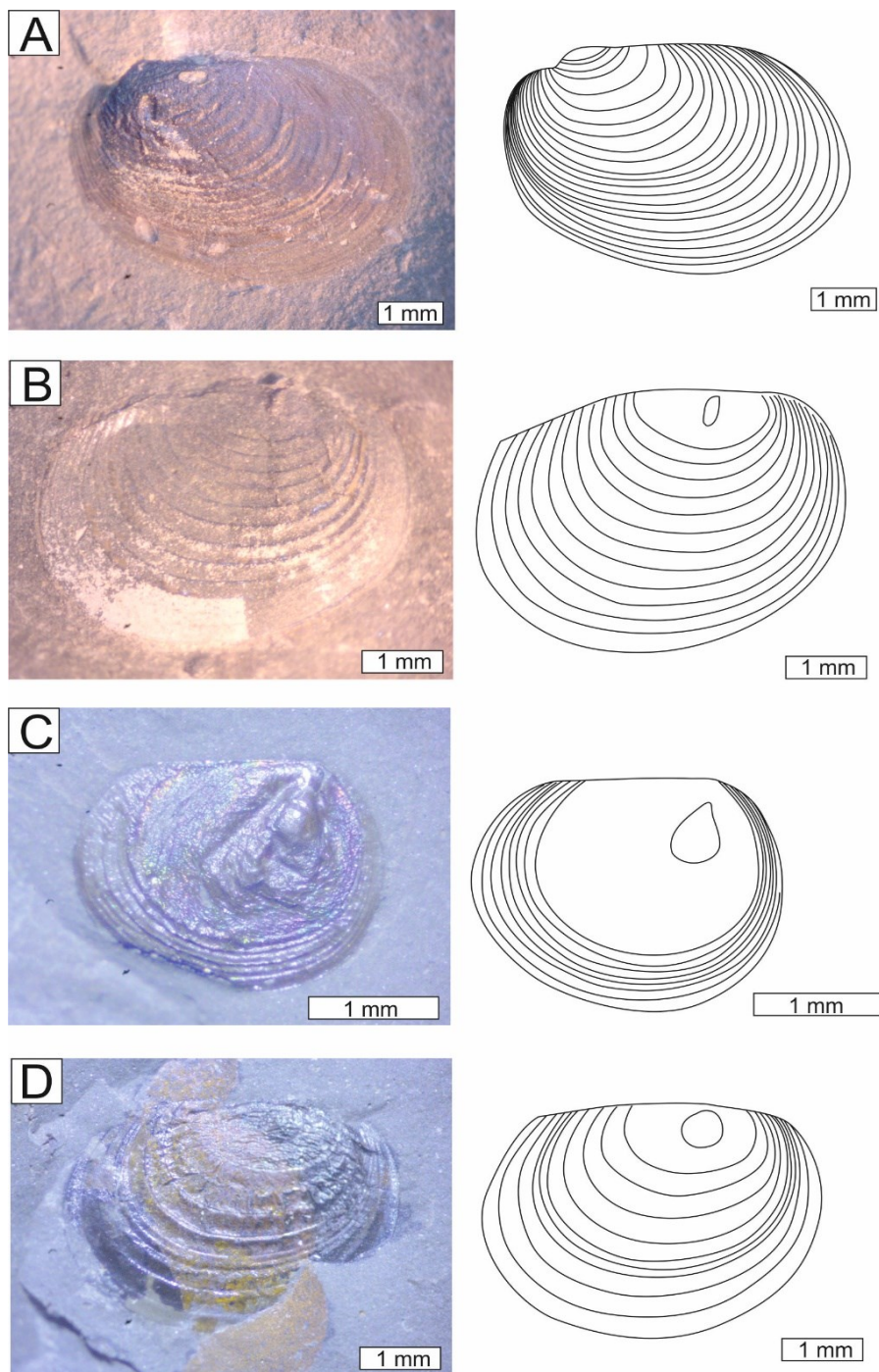


Fig. 2. Conchostracans from the Tailugan Fm. and Maltsevo Fm. (Upper Permian – Lower Triassic) of the Babii Kamen section. A: *Pseudestheria novacastrensis* (Mitchell, 1927) with the truncated valve and a supramarginal position of the umbo (39/BK15/1). B: *Cornia papillaria* Lutkevich, 1937 with a narrow spine on the larval valve (39/BK18/1). C: *Megasitum harmonicum* Novojilov, 1970 with the large larval valves and elongated cone (39/BK18/2). D: *Megasitum lopokolense* Novojilov, 1970 with the small larval valves and rounded cone (39/BK18/3).

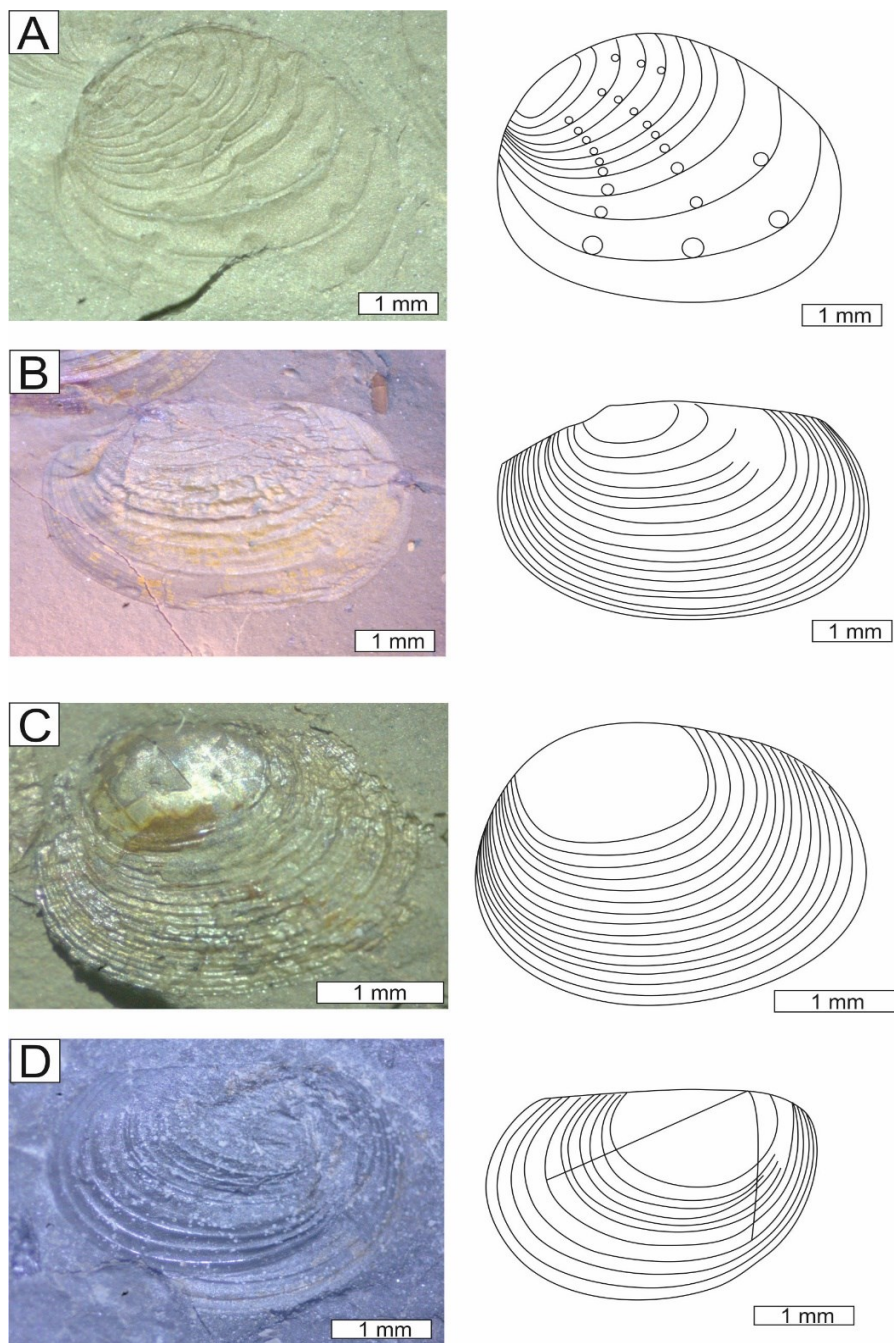


Fig. 3. Conchostracans from the Maltsevo Fm. of the Babii Kamen section. A: *Echinolimnadia mattoxi* Novojilov, 1965 with the several radial rows of spikes (39/BK18/4). B: *Concherisma tomensis* Novojilov, 1958 with the overhanging growth lines along the anterior margin (39/BK18/5). C: *Cyclotunguzites gutta* (Lutkevich, 1938) with a supramarginal position of the umbo (39/BK18/6). D: *Hemicycloleaia* Raymond, 1946 with three radial ribs on the valve (39/BK18/7).

The stratigraphic ranges of the genera *Echinolimnadia* and *Hemicycloleia* and the species *C. papillaria*, *M. harmonicum*, *M. lopokolense*, *E. mattoxi*, and *P. novacastrensis* in Kuznetsk Basin were clarified. These taxa are distributed within the Permian–Triassic transition.

Acknowledgments. We thank E.A. Zhegallo, A.S. Bashkuev, D.S. Kopylov, A.V. Khramov, A.S. Felker, and O.D. Strelnikova from Paleontological Institute of the Russian Academy of Sciences for their assistance during the sampling procedures.

This study was supported by the Russian Science Foundation (project no. 19-17-00178).

References

1. Vladimirovich V.P., Lebedev V.M., Popov Yu.N., Radchenko G.P., Shvedov N.A. Stratigraphy of the Triassic deposits of Central Siberia. In: *Stratigrafiya mezozoya i kainozoya Srednei Sibiri* [Stratigraphy of the Mesozoic and Cenozoic of Central Siberia]. Novosibirsk, Nauka, 1967, pp. 7–30. (In Russian)
2. Karasev E. On small pinnate leaves of peltasperm pteridosperms from the Early Triassic of the Kuznetsk Basin (Mal'tsevo Formation, Babii Kamen Locality). *Bot. Pac.*, 2015, vol. 4, no. 2, pp. 131–136. doi: 10.17581/bp.2015.04117.
3. Scholze F., Schneider J.W. Improved methodology of ‘conchostracan’ (Crustacea: Branchiopoda) classification for biostratigraphy. *Newsl. Stratigr.*, 2015, vol. 48, no. 3, pp. 287–298. doi: 10.1127/nos/2015/0065.
4. Zharinova V.V., Silantiev V.V. Conchostracans of the Maltsevo formation from Kuznetsk coal basin (Babii Kamen section): Permian or Triassic? *Paleostrat-2016. Moskva, 26–28 yanvarya 2016 g.* [Proc. Paleostrat-2016. Moscow, January 26–28, 2016], 2016, pp. 31–32. (In Russian)
5. Mitchell J. The fossil *Estheria* of Australia. *Proc. Linn. Soc. N. S. W.*, 1927, vol. 52, pp. 210–214.
6. Raymond E., Percy E. The genera of fossil Conchostraca – an order of bivalve Crustacea. *Bull. Mus. Comp. Zool. Harv. Coll.*, 1946, vol. 96, no. 3, pp. 217–307.
7. Novojilov N.I. *Recueil D'Articles sur les Phyllopo des Conchostraces*. Nauka, 1950, 128 p. (In French)
8. Molin V.A., Novojilov N.I. *Dvustvorchatye listonogie Permi i Triasa Severa SSSR* [Permian and Triassic Bivalved Phyllopods from the North of the USSR]. Nauka, 1965. 116 p. (In Russian)
9. Novojilov N.I. *Vymershie limnadioidei* [Extinct Limnadioidea]. Nauka, Moscow, 1970. 249 p. (In Russian)
10. Chunikhin S.A. Permian and Triassic conchostracans from Western Siberia. *Cand. Geol.-Mineral. Sci. Diss.* 2009. 151 p. (In Russian)
11. Novojilov N.I. Subclass Gnathostraca. Suborder Conchostraca. In: *Osnovy paleontologii (Chlenistonogie, trilobitoobraznye i rakoobraznye)* [Fundamentals of Paleontology (Arthropods, Trilobites and Crustaceans)]. Moscow, Nauka, 1960, pp. 220–253. (In Russian)
12. Novojilov N.I., Kapelka V. Nouveaux conchostraces de Siberie. In: *Annales de paleontologie*. Paris, 1968, pp. 109–129. (In French)
13. Chu D., Tong J., Benton M.J., Yu J., Huang Y. Mixed continental-marine biotas following the Permian-Triassic mass extinction in South and North China. *Palaeogeogr., Palaeoclimatol., Palaeoecol.*, 2019, vol. 519, pp. 95–107. doi: 10.1016/j.palaeo.2017.10.028.

14. Zharinova V.V., Silantiev V.V. About Early Triassic conchostracans of Pechora syncline. *Paleostrat-2018. Moskva, 29-31 yanvarya 2018 g.* [Paleostrat-2018. Moscow, January 29–31, 2018]. Moscow, 2018, pp. 30–31. (In Russian)

Received
March 29, 2019

Davydov Vladimir Ivanovich, Emeritus, Research Professor of Department of Geosciences

Boise State University
University Drive, Boise, ID, 83725, 1910, USA
E-mail: vdavydov@boisestate.edu

Zharinova Veronika Vladimirovna, Assistant Lecturer of Department of Paleontology and Stratigraphy

Kazan Federal University
ul. Kremlyovskaya 18, Kazan, 420008 Russia
E-mail: vevzharinova@kpfu.ru

Silantiev Vladimir Vladimirovich, Doctor of Geology and Mineralogy, Head of Department of Paleontology and Stratigraphy

Kazan Federal University
ul. Kremlyovskaya 18, Kazan, 420008 Russia
E-mail: Vladimir.Silantiev@kpfu.ru

УДК 57.07

doi: 10.26907/2542-064X.2019.2.339-347

Позднепермские и раннетриасовые конхостраки из разреза Бабий Камень (Кузнецкий угольный бассейн)

В.И. Давыдов¹, В.В. Жаринова², В.В. Силантьев²

¹Государственный университет Бойсе, г. Бойсе, 1910, США

²Казанский (Приволжский) федеральный университет, г. Казань, 420008, Россия

Аннотация

Изучены позднепермские и раннетриасовые конхостраки из разреза Бабий Камень в Западной Сибири. Исследованные экземпляры конхостраков были собраны во время полевых работ в 2015–2018 гг. Обнаружено, что пермские и триасовые отложения разреза Бабий Камень содержат богатый в видовом отношении комплекс конхостраков, включающий пять позднепермских видов (*Pseudestheria novacastrensis* (Mitchell, 1927), *Cornia papillaria* (Lutkevich, 1937), *Megasitum harmonicum* Novojilov, 1970, *Megasitum lopokolense* Novojilov, 1970, *Echinolimnadia mattoxi* Novojilov, 1965) и два раннетриасовых вида (*Concherisma tomensis* Novojilov, 1958, *Cyclotunguzites gutta* (Lutkevich, 1938)). Все вышеперечисленные виды конхостраков известны из разрезов перми и триаса других регионов Земли и имеют большое значение для биостратиграфии континентальных отложений.

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

Благодарность. Авторы выражают благодарность сотрудникам Палеонтологического института Российской академии наук Е.А. Жегалло, А.С. Башкуеву, Д.С. Копылову, А.С. Фелькер, О.Д. Стрельниковой за помощь в сборе материала.

Исследование выполнено в рамках научного проекта Российского научного фонда № 19-17-00178.

Поступила в редакцию
29.03.19

Давыдов Владимир Иванович, почетный профессор, профессор кафедры наук о Земле

Государственный университет Бойсе

Университет Драйв, ID, 83725, г. Бойсе, 1910, США

E-mail: vdavydov@boisestate.edu

Жаринова Вероника Владимировна, ассистент кафедры палеонтологии и стратиграфии

Казанский (Приволжский) федеральный университет

ул. Кремлевская, д. 18, г. Казань, 420008, Россия

E-mail: vevzharinova@kpfu.ru

Силантьев Владимир Владимирович, доктор геолого-минералогических наук, заведующий кафедрой палеонтологии и стратиграфии

Казанский (Приволжский) федеральный университет

ул. Кремлевская, д. 18, г. Казань, 420008, Россия

E-mail: Vladimir.Silantiev@kpfu.ru

***For citation:** Davydov V.I., Zharinova V.V., Silantiev V.V. Late Permian and Early Triassic conchostracans from the Babii Kamen section (Kuznetsk coal basin). *Uchenye Zapiski Kazanskogo Universiteta. Seriya Estestvennye Nauki*, 2019, vol. 161, no. 2, pp. 339–347. doi: 10.26907/2542-064X.2019.2.339-347.*

***Для цитирования:** Davydov V.I., Zharinova V.V., Silantiev V.V. Late Permian and Early Triassic conchostracans from the Babii Kamen section (Kuznetsk coal basin) // Учен. зап. Казан. ун-та. Сер. Естеств. науки. – 2019. – Т. 161, кн. 2. – С. 339–347. – doi: 10.26907/2542-064X.2019.2.339-347.*