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Original article

Late Norian (Triassic) Radiolaria from the Kotel'nyi Island (New Siberian Islands, Arctic, Russia)

Des Radiolaires du Norien supérieur (Trias) issus de l'île Kotel'nyi (Îles de Nouvelle Sibérie, Arctique, Russie)

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Abstract

Two radiolarian assemblages were recovered from upper Norian strata of the Kotel'nyi Island (Russia); the first assemblage, from the *Monotis zabaikalica* Subzone (lower part of Upper Norian), is represented by *Betraccium inornatum* Blome, *Dumitricaella* (?) *parva* Sugiyama, *Ferresium titulense* Blome and 24 other species; the second assemblage, from the *Monotis subcircularis* Subzone (upper part of Upper Norian), is represented by *Crucella* sp. cf. *C. angulosa* Carter, *Kahlerosphaera acris* Bragin, *K.* sp. cf. *K. parvispinosa* Kozur & Mostler, *Pseudohagiastrum crassum* (Carter) and 11 other species. Both assemblages have common taxa with Upper Norian and Rhaetian radiolarian assemblages of British Columbia and they display clear Boreal features: low taxonomic diversity, abundance of taxa known from high-latitude regions, absence or rare presence of taxa known from low-latitude areas. The presence of early representatives of nassellarian genera *Droltus* and *Parahsuum* is very distinctive. Six new species are described: *Pseudohagiastrum spinosum* nov. sp., *Cantalum boreale* nov. sp., *Plafkerium carteri* nov. sp., *Droltus guttaeformis* nov. sp., *Laxtorum blomei* nov. sp., *L. glacialis* nov. sp.

Keywords: Radiolaria; Triassic; Upper Norian; Stratigraphy; Arctic; Russia

Résumé

Deux assemblages de radiolaires ont été extraits des niveaux du Norien supérieur de l'île Kotel'nyi (Russie) ; le premier assemblage, issu de la sous-zone à *Monotis zabaikalica* (partie inférieure de Norien supérieur), est représenté par *Betraccium inornatum* Blome, *Dumitricaella* (?) *parva* Sugiyama, *Ferresium titulense* Blome et 24 autres espèces ; le deuxième assemblage, issu de la sous-zone à *Monotis subcircularis* (partie supérieure du Norien supérieur), est représenté par *Crucella* sp. cf. *C. angulosa* Carter, *Kahlerosphaera acris* Bragin, *K.* sp. cf. *K. parvispinosa* Kozur & Mostler, *Pseudohagiastrum crassum* (Carter) et 11 autres espèces. Ces deux assemblages contiennent des taxa en commun avec des assemblages de radiolaires du Norien supérieur et du Rhétien de Colombie-Britannique et ils montrent des caractères boréaux bien clairs : faible diversité taxonomique, abondance des taxa connus des régions de hautes latitudes, absence ou rare présence de taxa connus des endroits situés dans les basses latitudes. La présence des représentants primitifs des genres de nassellaires *Droltus* et *Parahsuum* est bien caractéristique. Six nouvelles espèces sont décrites : *Pseudohagiastrum spinosum* nov. sp., *Cantalum boreale* nov. sp., *Plafkerium carteri* nov. sp., *Droltus guttaeformis* nov. sp., *Laxtorum blomei* nov. sp., *L. glacialis* nov. sp.

Mots clés : Radiolaires ; Trias ; Norien supérieur ; Stratigraphie ; Arctique ; Russie

1. Introduction

It is well known that paleobiogeographical differences between low- and high-latitude fauna increased gradually during the Triassic (Dagys et al., 1979; Konstantinov et al., 2003).

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As a result, the taxonomic composition of stratigraphically valuable groups of organisms (primarily cephalopods and bivalves) became significantly differentiated. This complicates extremely the correlation of high- and low-latitude sections of the Triassic. Direct Boreal–Tethyan correlation of Upper Triassic beds is rarely successful on the basis of mollusks; "intermediate" sections containing a mixed fauna (British Columbia) are usually used for this purpose (Tozer, 1994).

Triassic radiolarian assemblages also show significant differences in taxonomic composition between high and low-latitudinal assemblages. Nevertheless, this plankton group includes many species with wide geographical ranges (or cosmopolitan) in both extant and extinct faunas. Studies of the boreal Triassic (Egorov and Bragin, 1995; Aita and Bragin, 1999; Bragin and Egorov, 2000; Bragin, 2011, 2014; Hori et al., 2015) have shown characteristic features of boreal radiolarian assemblages; they always include certain species known in more southerly regions, which are widespread species, or probably even cosmopolitans. At the same time, these assemblages often include or are even dominated by typical high-latitude taxa that sometimes show bipolar distribution.

The knowledge of Triassic boreal radiolarians is currently rather poor but they have been recorded in a few sections (Egorov and Bragin, 1995; Aita and Bragin, 1999; Bragin and Egorov, 2000; Tekin et al., 2006; Bragin, 2011, 2014; Bragin et al., 2012). Therefore, each new discovery of Triassic boreal radiolarians is of great interest, expanding the knowledge of the taxonomic composition, stratigraphic and paleobiogeographical distribution of many species. The dynamics and character of development of boreal assemblages are of particular interest, showing the evolution and important changes in assemblages, which reflect shifts of conditions and migration of thermophilic organisms, caused by either warming or transgressions, which in turn results in the expansion of links between basins and, hence, an increase in similarity in the taxonomic composition of assemblages from different paleobiochores.

The purpose of the present study is the examination and description of previously unknown Upper Norian (Triassic) radiolarians of the Kotel'nyi Island. This area belongs to the Arctic Region, which is still poorly understood with reference to Triassic radiolarians. At the same time, good preservation, relatively diverse taxonomic composition, and co-occurrence of radiolarians with key ortho- and parastratigraphic macrofossils provide rather complete information on the composition of radiolarian assemblages and their stratigraphical position.

2. Geological setting

The Triassic deposits of Kotel'nyi Island are known in its northern, central and southernmost parts. Large outcrops are observed in the central part of the island where they form cores of broad synclinals. The Triassic is mostly represented by fine-grained clastics that crop out in the middle reaches of the Balyktakh River and in the valleys of its tributaries: Pryamaya, Tikhaya, Sheina, Tuguttakh, and Tuor-Yuryakh rivers (Fig. 1). In this area, the Triassic section was repeatedly investigated by different researchers and is described in detail in several works

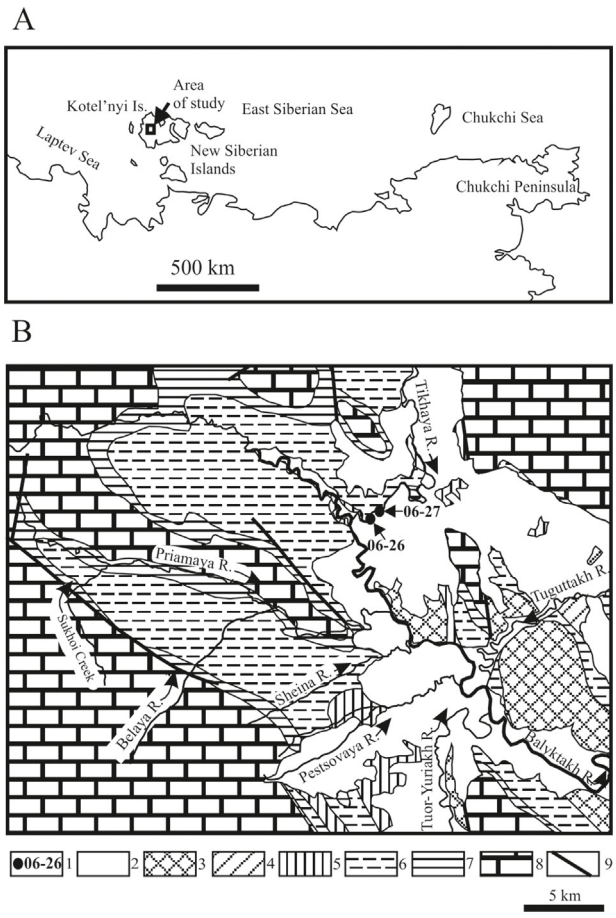

Fig. 1. Maps of location and geological structure of the studied area. A. Geographical position of the New Siberian Islands and area of study. B. Geological structure of the central part of Kotel'nyi Island. Designations: (*1*) outcrops where Upper Norian radiolarians have been recorded; (*2*) Quaternary; (*3*) Lower Cretaceous; (*4*) Lower Jurassic; (*5*) Rhaetian–Liassic; (*6*) Upper Triassic; (*7*) Lower and Middle Triassic; (*8*) Paleozoic; and (*9*) faults. Modified from Bragin (2011).

(Preobrazhenskaya et al., 1975; Korchinskaya, 1977; Egorov et al., 1987; Konstantinov et al., 2003). The section includes sediments of all three series of the Triassic System with the maximal stratigraphic completeness characteristic of the upper series. The Triassic of the Kotel'nyi Island is well characterized by cephalopods, bivalves, foraminifers and radiolarians. Middle Triassic to Lower Norian radiolaria were studied during recent years (Bragin, 2011, 2014; Bragin et al., 2012). New data on Upper Norian radiolarians are presented herein. These findings were made from two samples of E.S. Sobolev (Institute of Geology and Geophysics of Siberian Branch of RAS, Novosibirsk, Russia) collected in 2009 and one sample collected by the author in 2006.

The most complete Upper Norian section is known on the lower flow of Tikhaya River (Figs. 1 and 2). Upper Norian strata are represented by clays and claystones with layers of limestones, sideritic and phosphatic concretions. They are observed in two isolated outcrops on the right bank of Tikhaya River (Fig. 2) and their total thickness can be estimated as 250 m.