

First Record of *Cadoceras* (Ammonoidea: Cardioceratidae) from the Middle Callovian of Turkmenistan

V. V. Mitta^{a, b, *}

^a Borissiak Paleontological Institute, Russian Academy of Sciences, Moscow, 117647 Russia

^b Cherepovets State University, Cherepovets, 162600 Russia

*e-mail: mitta@paleo.ru

Received April 19, 2024; revised April 22, 2024; accepted May 6, 2024

Abstract—The first specimen of *Cadoceras milaschewici* (Nikitin) found in the Middle Callovian *Jason* Zone of Tuarkyr (northwestern Turkmenistan) is discussed. Rare records of ammonites of the subfamily Cadoceratinae (*Cadoceras*, *Pseudocadoceras*, *Chamousetia*) are known from the Lower Callovian of adjacent areas—the Northern Caucasus, Mangyshlak, and the Bolshoi Balkhan Ridge. The only published find of a Middle Callovian *Cadoceras* from the Peri-Caspian region comes from the *Jason* Zone of Dagestan (Northern Caucasus). It is possible that the local environments were not suitable for *Cadoceras*, a genus with a cadiconic shell widely represented in the Upper Bathonian–Middle Callovian of the Russian Platform.

Keywords: Stephanoceratoidea, Cadoceratinae, Middle Jurassic, Middle Callovian, Tuarkyr

DOI: 10.1134/S0031030124600689

INTRODUCTION

Representatives of the genus *Cadoceras* Fischer, 1882, type of the subfamily Cadoceratinae Hyatt, 1900 (family Cardioceratidae Siemiradzki, 1891 of the superfamily Stephanoceratoidea Neumayr, 1875), were widespread in the Middle Jurassic Bathonian–Callovian marine basins of the Northern Hemisphere. The main range of this genus was in the boreal and subboreal regions, but at the boundary of the Bathonian and Callovian, *Cadoceras* spread far to the south, up to and including the Caucasus. In the Middle Callovian, the geographic distribution of species of the genus *Cadoceras* (as well as the entire subfamily Cadoceratinae) sharply decreased along the southern periphery of the range, and only a few specimens were published from the Tethyan regions.

The article discusses the discovery of an ammonite of the genus *Cadoceras* in the Callovian of Tuarkyr, a locality in the north-west of Turkmenistan. The material studied is housed in the Borissiak Paleontological Institute, Russian Academy of Sciences (PIN), coll. no. 4508.

HISTORY OF STUDY

Tuarkyr is an area south of the Ustyurt cliffs and east of the Kara-Bogaz-Gol Bay, represented by a system of low mountain ranges combined with sandy desert and salt marshes (Fig. 1). The first information about the geological structure of the Tuarkyr Anticline was obtained by Andrusov (1889), who established there the presence of the Middle–Upper Jurassic and Lower Cretaceous beds. The paleontological material collected by Andrusov was monographically studied

by Semenov (1896); all the ammonites he described were assigned to the Callovian.

In the second half of the 20th century, ammonites and biostratigraphy of the Callovian–lower Oxfordian of Tuarkyr were studied by K.N. Amanniyazov. He published a number of papers (Amanniyazov, 1960a, 1960b, 1962a; etc.) and two monographs (Amanniyazov, 1962b, 1971).

Local (lithostratigraphic) Callovian units on Tuarkyr were proposed by N.V. Besnosov and V.V. Kutuzova (1983), they established the Tuerdag (Lower Callovian–Upper Callovian *Athleta* Zone) and Tuarkyr (upper *Athleta* Zone–Lower Oxfordian) formations.

In 1988–1989 the author had the opportunity to conduct fieldwork in Tuarkyr. Over the course of two field seasons, extensive material of ammonites was collected from the Callovian and lower Oxfordian of the area. Of all this material, only one species has been published to date, *Pachyceras efimovae* Mitta from the Upper Callovian *Lamberti* Zone (Mitta, 1992).

LOCALITY AND MATERIAL

The locality (Tuar-2) is at the northern tip of the Tuarkyr Mountains, in the vicinity of the Tuar Wells (~2 km south of the village of Tuar) (Fig. 1b). The described specimen was found 1.5 m above the base of Bed 2¹ in the sections of the Tuerdag Formation, composed of a thick series of alternating clayey sands, calcar-

¹ The author plans to publish the description and paleontological characteristics of the Callovian–Oxfordian sections of Tuarkyr later.

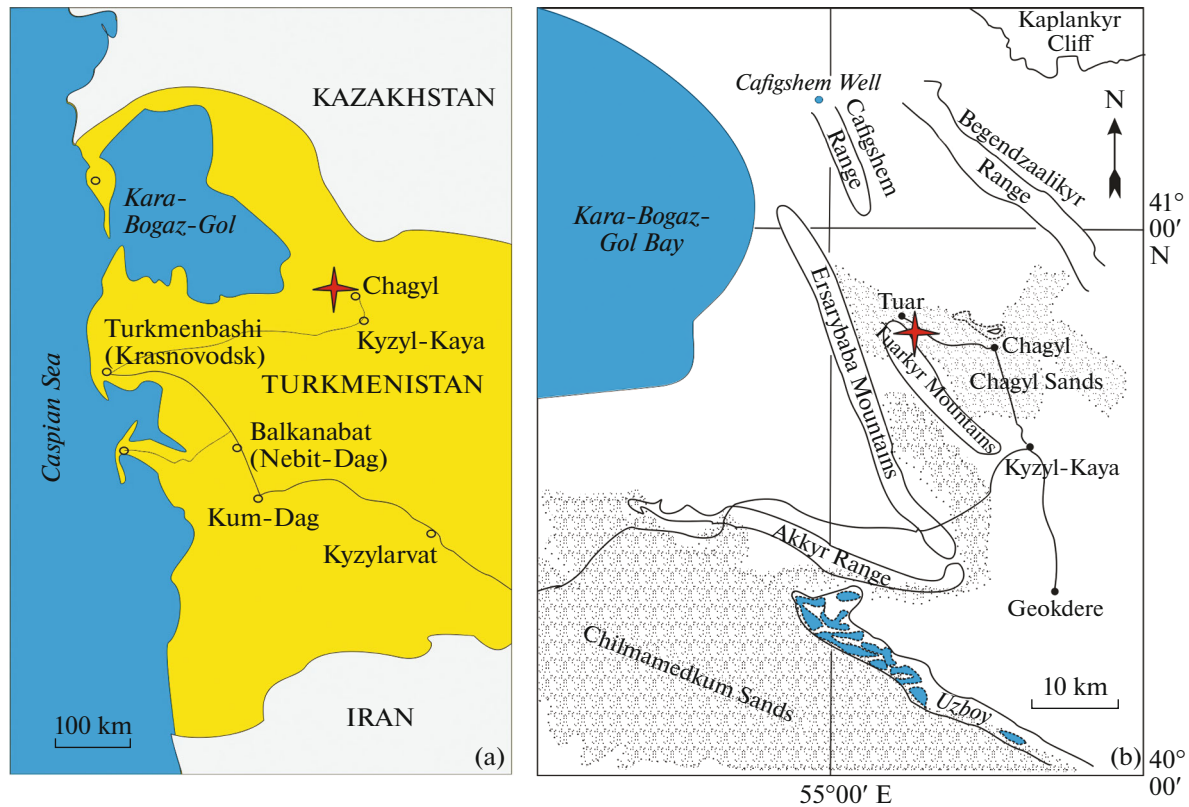


Fig. 1. Location of Tuar-2: (a) general scheme, (b) detailed map.

eous sandstones, sandy limestones and clays. Above, 2.5 m from the base of Bed 2, numerous cosmoceratids of the Middle Callovian *Jason* Zone were found (*Kosmoceras* ex gr. *jason* (Reinecke)), and 0.5 m higher, *Erymnoceras* of the Middle Callovian *Coronatum* Zone appear.

The specimen under discussion (Fig. 2) is represented by a core with the remains of a shell, replaced by yellowish-gray sandy limestone, inlaid with calcite crystals from the inside. The maximum shell diameter is 47 mm; whorls are inflated, round-trapezoidal in cross-section, with a width noticeably greater than the height. The umbilicus is moderately narrow, deep. The umbilical wall is almost vertical, the umbilical shoulder is rounded. The ornamentation is poorly expressed; the ribs on the flanks are subradial, on the venter, they are slightly bent forward.

Based on the shell shape, this ammonite belongs to the group of species of the genus *Cadoceras*, which characterize the upper parts of the Lower (*Calloviense* Zone)–lower part of the Middle Callovian (*Jason* Zone) on the Russian Platform. This is the phyletic lineage “*Rondiceras*”² *geerzense* (Behrendsen in Wermbter, 1891) → “*R.*” *tsheffkini* (d’Orbigny, 1845) → “*R.*” *sysolae* (Khudyaev, 1927) → “*R.*” *milaschewici* (Nikitin, 1881) (Mitta, 2000).

² The name *Rondiceras* Troitzkaya, 1955 recognized (Mitta et al., 2015; Mitta, 2016) as a junior subjective synonym of *Cadoceras* Fischer, 1882.

Taking into account the weak ornamentation, this specimen is most similar to *Cadoceras milaschewici* (lectotype³: Nikitin, 1881, pl. 3, fig. 25), species, characteristic of the *Jason* Zone. This identification is also confirmed by the stratigraphic position of the find in the geological section immediately below the ammonites of the *Jason* Zone. It is possible to clarify the position of the specimen under discussion in the biostratigraphic scale at the infrazonal level after studying other ammonites from the Callovian sections in the vicinity of the Tuar wells.

DISCUSSION

As mentioned above, the specimen under discussion is the first and only discovery to date of a representative of the genus *Cadoceras* not only in Tuar-2 or Turkmenistan, but throughout Central Asia. From the Callovian of Turkmenistan, only one record of a representative of the subfamily Cadoceratinae is known. This is a record of *Pseudocadoceras* sp. from the base of the Dzhebelata Formation (Lower Callovian *Koenigi* [=Gowerianus] and *Calloviense* zones) of the Great Balkhan Ridge (Besnosov and Mitta, 1996, pl. 4, fig. 38; 2000, p. 70, pl. 18, fig. 17).

³ The nomenclatural status of this specimen was established by Mitta (2000, p. 57); prior to that it had been considered as the holotype.

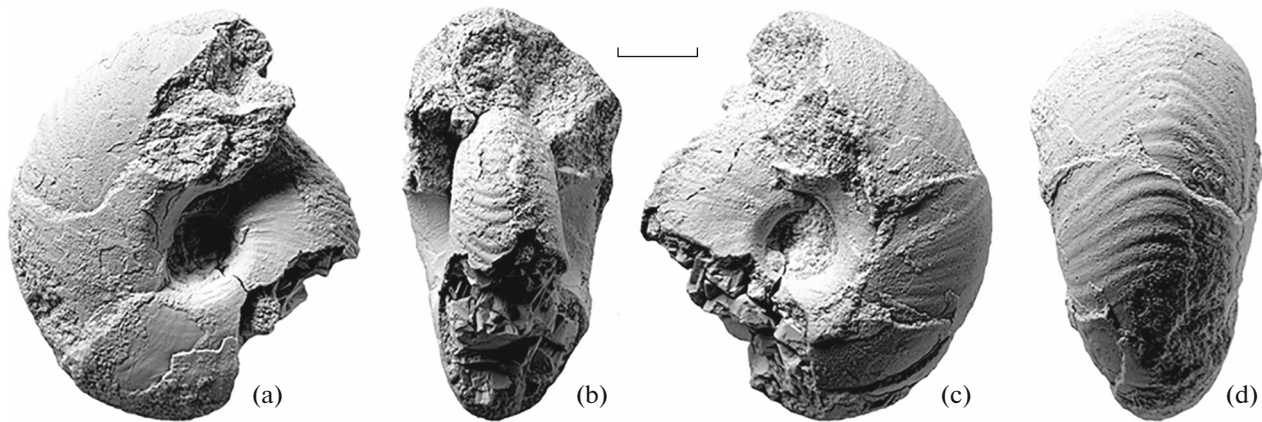


Fig. 2. *Cadoceras milaschewici* (Nikitin), specimen PIN, no. 4508/3; Turkmenistan, Balkan velayat (until 1991: Krasnovodsk region of the Turkmenskaya SSR), vicinity of Tuar Wells, Tuar-2 section, Bed 2; Middle Callovian, *Jason* Zone. Coll. by the author in 1989. Scale bar 10 mm.

Rare finds of representatives of the subfamily Cadoceratinae are known from the Callovian of the territory of Mangyshlak (Kazakhstan) adjacent to Tuarkyr. This is *Chamoussetia* sp. juv. from the *Koenigi* Zone (Repin and Rashvan, 1996a, p. 81, pl. 44, figs. 4, 5), and the same small-sized shells, identified as *Pseudocadoceras* (*Pseudocadoceras*) *petelini* (Pompeckj) (ibid., p. 69, pl. 39, fig. 2, 4; Repin and Rashvan, 1996b, pl. 2, fig. 7), originating from the Lower-Middle Callovian boundary beds.

It is noteworthy that the microconchs of *Pseudocadoceras* and the macroconchs of early Cadoceratinae (genera *Cadoceras*, *Cadochamoussetia*, *Chamoussetia*) are considered by most researchers to be dimorphic pairs.

In the Northern Caucasus, the genus *Cadoceras* is represented by quite diverse species in the Upper Bathonian and the basal Callovian (Lominadze, 2004; Mitta, 2011a, 2011b). However, from the Middle Callovian of this region, only one record of a small macroconch is known, identified as *Cadoceras* (*Streptocadoceras*) *wosnessenskii* (Grewingk) (Sakharov, 1988, p. 320, text-fig. 3; here, Fig. 3). This ammonite comes from the lower Armkhi Formation⁴ (Rostovtsev, 1992, p. 137) of Dagestan and was assigned by A.S. Sakharov to the *Jason* Zone.

Thus, representatives of the subfamily Cadoceratinae in the family Cardioceratidae are quite rare in the Lower Callovian of Mangyshlak, the Northern Caucasus and the Eastern Caspian region. From the Middle Callovian of these adjacent regions, only two records of cadoceratins (genus *Cadoceras*) are known. Numerous cardioceratids appear here again only in the Upper Callovian and are represented by the genus *Quenstedtoceras* Hyatt, 1877 (subfamily Cardioceratinae Siemiradzki, 1891).

To the north of the Caspian regions, in the southeast of the Russian Platform (Saratov Volga region),

Lower Callovian cadoceratins are represented by a variety of taxa, however, from the Middle Callovian (*Jason* Zone), only one species is known there—*Cadoceras milaschewici* (Nikitin), represented mostly by small specimens (Kamysheva -Elpatyevskaya et al., 1959, p. 12, text-figs. 3–5, etc.). Further north, in the Middle and Upper Volga region, the diversity of Middle Callovian cadoceratins increases significantly—in addition to *C. milaschewici*, its descendants belonging to the genus *Longaeviceras*—*L. stenolobum* (Keyserling) and its descendants are not uncommon.

According to all available data, there were no paleogeographic barriers between the southeast of the Russian Platform and the Turan Plate in the Middle Callovian time (*Paleogeografiya*..., 1975; etc.). The taxonomic composition of the Middle Callovian ammonite assemblages of Tuarkyr, Mangyshlak and the Volga region is generally very similar and is represented mainly by species of the families Kosmoceratidae, Perisphinctidae, Oppeliidae and Pachyceratidae, often common to all these regions (Amanniyazov,

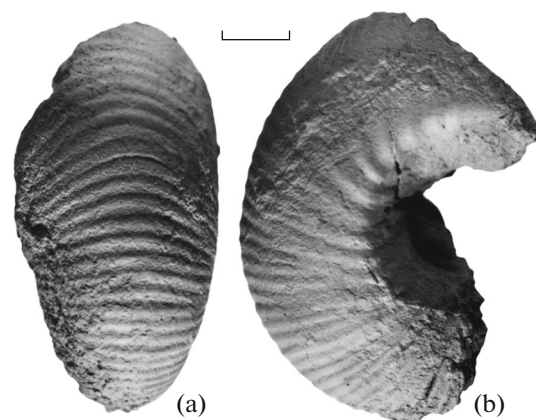


Fig. 3. *Cadoceras wosnessenskii* (Grewingk) (after Sakharov, 1988, text-fig. 3); Dagestan, right bank of the Avarskoe Koisu River, vicinity of the village of Golotl; Middle Callovian, *Jason* Zone. Scale bar 10 mm.

⁴ Sakharov (1988, p. 320) mentioned the Zaib Formation proposed by him previously (Sakharov et al., 1983, p. 56); however, this name was not accepted by subsequent authors.

1962b; Repin and Rashvan, 1996b). It is possible that the environments in the Caspian Callovian sea basin were not favorable for cadiconic shells characteristic of macroconchs of the genus *Cadoceras*.

ACKNOWLEDGMENTS

My colleagues, employees of the lithological-stratigraphic research department of the All-Union Scientific Research Geological Petroleum Institute (VNIGNI), took part in field work on the Mesozoic sections of Tuarkyr. I consider it my duty to express my heartfelt gratitude to them for their work in the very difficult climatic conditions of Tuarkyr, with extreme heat and strict limitation of fresh water.

FUNDING

This work was financed from the budget of the Borissiak Paleontological Institute of the Russian Academy of Sciences. No additional grants were received to conduct or direct this specific study.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This work does not contain any studies involving human or animal subjects.

CONFLICT OF INTEREST

The author of this work declares that he has no conflict of interest.

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Translated by S. Nikolaeva

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