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A Unique Find of the Ammonite *Kamerunoceras* (Acanthoceratidae, Ammonoidea) from the Turonian (Upper Cretaceous) of the South–Western Crimea

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Abstract—A Turonian ammonite, *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) has been found for the first time in the southwestern Crimea, in the section of the Aksu-Dere ravine, northward of the village of Kudrino (Kacha River basin). This is the first discovery of representatives of this genus in Russia.

Keywords: ammonite, *Kamerunoceras* sp. ex gr. *turoniense*, Upper Cretaceous, Turonian, biostratigraphy, southwestern Crimea

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INTRODUCTION

Finds of ammonites are relatively rare in the Turonian deposits of Crimea and the vast majority of them originate from deposits of the ~~Upper~~ Turonian Substage (Naidin et al., 1981; Alekseev, 1989; Arkad'ev and Bogdanova, 1997). The only mention of ~~Lower~~ Turonian ammonites from sections of the Kacha–Bodrak interfluve (members ~~8~~ and/or ~~9~~) is given in (Naidin et al., 1981): "~~family~~ Collignoniceratinae Wright et Wright (unidentifiable cast) and *Prionocyclus*? aff. *neptuni* (Geinitz)." Unfortunately, these finds are not depicted and are absent in the collections, which makes it impossible to evaluate them.

In 2023, P.A. Fokin found a large fragment of the ammonite *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) in the reference section of Turonian deposits of the southwestern Crimea, in the Aksu-Dere ravine, during student practice. The find was made in a dirt road, on the rise from the ravine to the watershed, in Member ~~9~~ of unevenly layered limestones with flint nodules, about 35 m above the well-known level of bituminous shale and top of the Cenomanian Stage (Figs. 1, 2). This is the first record of *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) not only in the southwestern Crimea but also throughout Russia. Therefore, despite its poor preservation, it is of significant value and expands our knowledge of the distribution of representatives of this genus.

PALEONTOLOGICAL DESCRIPTION

The ammonite was described using standard terminology and measurements of shells given in (Arkad'ev and Bogdanova, 1997). The collection is deposited in the Museum of Earth Science, Moscow State University under no. 149.

Order Ammonoidea Zittel, 1884
Suborder Ammonitina Hyatt, 1889
Superfamily Acanthoceratoidea de Grossouvre, 1894
Family Acanthoceratidae de Grossouvre, 1894
Subfamily Euomphaloceratinae Cooper, 1978
Genus *Kamerunoceras* Reyment, 1954
Kamerunoceras sp. ex gr. *turoniense* (d'Orbigny, 1850)
Figs. 3a, 3b

Description. The specimen is represented by approximately a quarter of a large whorl belonging to the living chamber. It is strongly flattened parallel to the symmetry plane and partially replaced by white and light gray flint. Shell is semi-evolute; its diameter was about 130 mm. The height of the whorl measured between the ribs is 50 mm. It is difficult to determine the cross-sectional shape. It is probably closer to the rectangular or square shape (Fig. 3b). Ribs are slightly curved backwards, rough, and ~~single.~~ They begin from the umbilical ~~suture~~ almost unnoticeably and are ornamented with a umbilical tubercle or an elongated, laterally flattened swelling. Ribs are significantly weakened in the middle part of the sides and an elongated swelling appears towards the ventral side and

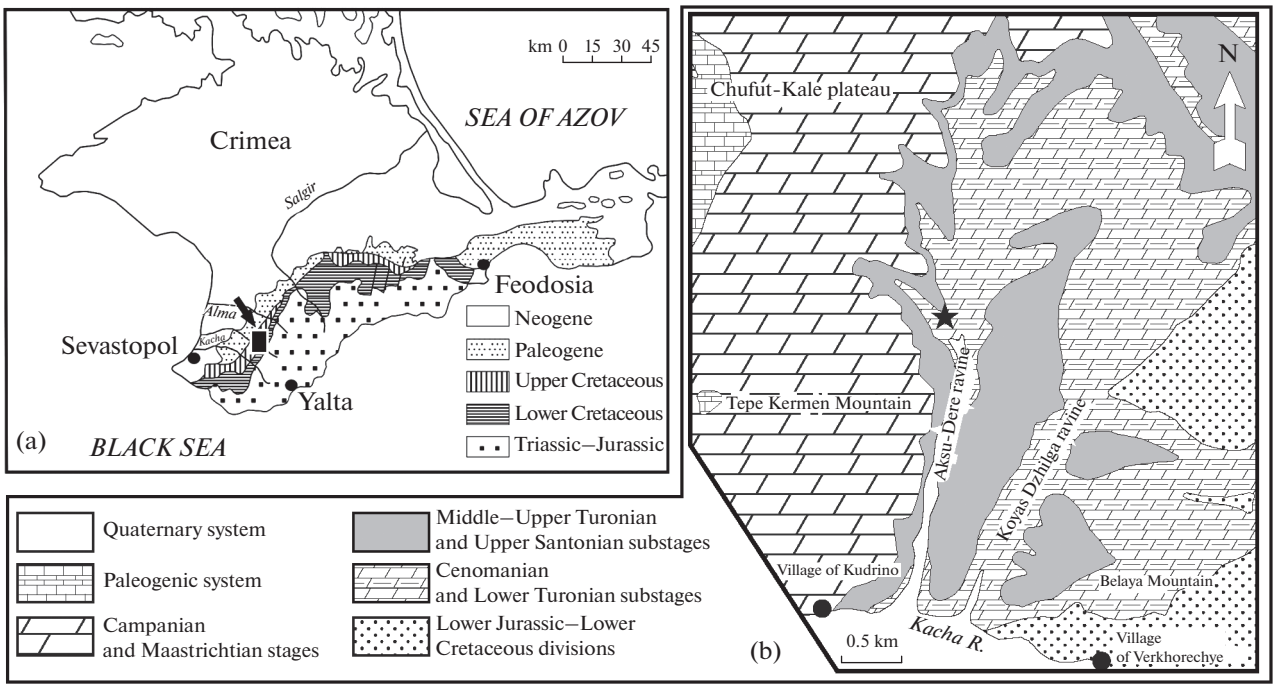

Fig. 1. Location of the section: (a) in Crimea (arrow), (b) in the Kacha River basin, to the north of the village of Kudrino (asterisk).

ends at the ventral bend with a slightly flattened internal ventrolateral tubercle. Another tubercle (external ventrolateral high and pointed tubercle) is located next to the previous one, but on the ventral side (Fig. 3b). The ventral side is almost invisible, which makes it difficult to establish the presence of a ~~carina~~; in any case, it is hardly pronounced. There are seven ribs on a quarter of the whorl.

Comparison. The discovered specimen is close to representatives of different Turonian ammonite genera from different families. It resembles large whorls of some individuals of *Collignoniceras* Breistroffer, 1947 and *Prionocyclus* Meek, 1876 of the family Collignoniceratidae Wright et Wright, 1951; however, the latter have a well-developed ~~carina~~ and often additional thinner lateral ribs on the outer whorls. Among *Prionocyclus*, the coarse ribbed form of *Prionocyclus germari* (Reuss) is closest to our specimen; however, this species is recorded in the ~~Upper~~ Turonian (Kennedy et al., 2001).

Among the ~~Early~~ Turonian representatives of the subfamily Euomphaloceratinae Cooper, 1978, two genera, *Pseudaspidoceras* Hyatt, 1903 and *Kamerunoceras* Reyment, 1954, are closest to our specimen. In *Pseudaspidoceras*, robs are almost always smoothed or there are thinner secondary, sometimes loop-like ribs on large whorls. Among the most coarsely ribbed forms, which have no additional ribs, are *Pseudaspidoceras paganum* Reyment and *Pseudaspidoceras pseudonodosoides* (Chof.); however, both of them have low external ventrolateral tubercles or have none of them at all. The pattern of ventrolateral tubercles is most similar to our specimen only in *Kamerunoceras*. Among the representatives of this genus, *Kamerunoceras turoniense* (d'Orb.) (a zonal form that begins the ~~Middle~~ Turonian sequence) is most similar to our specimen. *Kamerunoceras jacobsoni* Reyment is also a closely related form; however, it has equal ventrolateral tubercles, which is not observed in our specimen. Based on the above, we believe that the most accurate indication for the discovered ammonite is *Kamerunoceras* sp. ex gr. *turoniense* (d'Orbigny, 1850).

A detailed description of the species *Kamerunoceras turoniense* (d'Orb.), an image of the lectotype, and the discussion of the problems of its selection are given in (Kennedy and Wright, 1979). It contains a list of synonyms; supplemented synonyms for this species can be found in (Ayoub-Hannaa and Fürsich, 2012; Kennedy and Gale, 2020).

Occurrence. The upper part of the ~~Lower~~ Turonian–lower part of the ~~Middle~~ Turonian of England, France, Spain, Portugal, Morocco, Algeria, Tunisia, Lebanon, Egypt, Israel, Nigeria, Cameroon, Madagascar, Mexico, Texas and New Mexico (United States), Brazil, Colombia, Venezuela, Tajikistan (?), and Crimea (Fig. 4).

Material. One specimen, MZ MGU no. 149/7.

DISCUSSION

In accordance with the decisions of the Colloquium on the Turonian Stage, a recommendation on the three-~~member~~ division of the Turonian (Robaszynski, 1983; Bengtson, 1996), including its

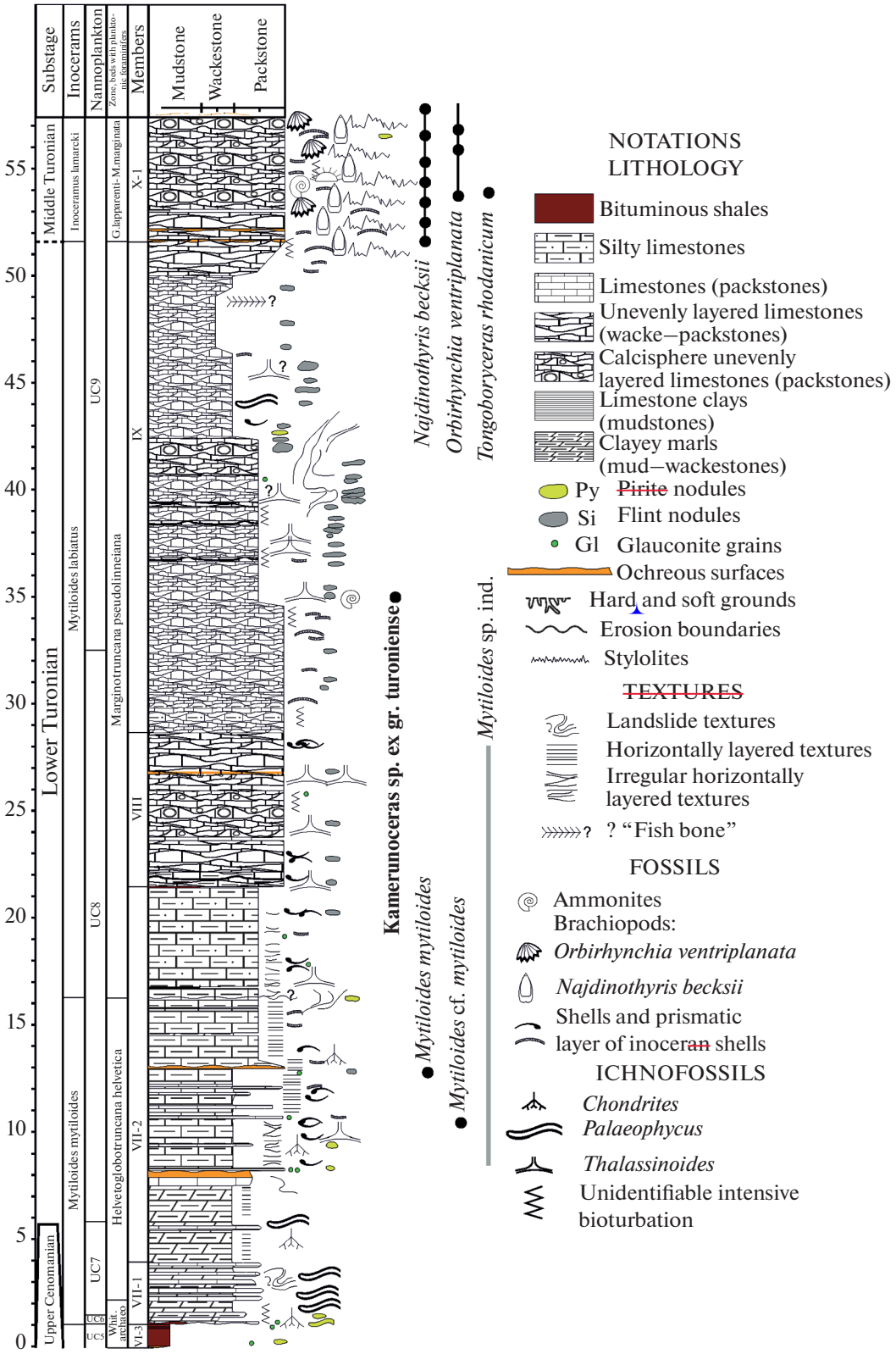

Fig. 2. Structure of the lower part of the ~~Lower–Middle~~ Turonian section of the Aksu-Dere ravine and distribution of macrofauna, including *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) (our data). The boundaries of the zones of inocerams and planktonic foraminifers are indicated according to (Alekseev, 1989; Kopaevich and Walaszczyk, 1990; and Kopaevich and Walaszczyk, 1993) and the boundaries of the nannoplankton zones according to (Shcherbinina and Gavrilov, 2016).

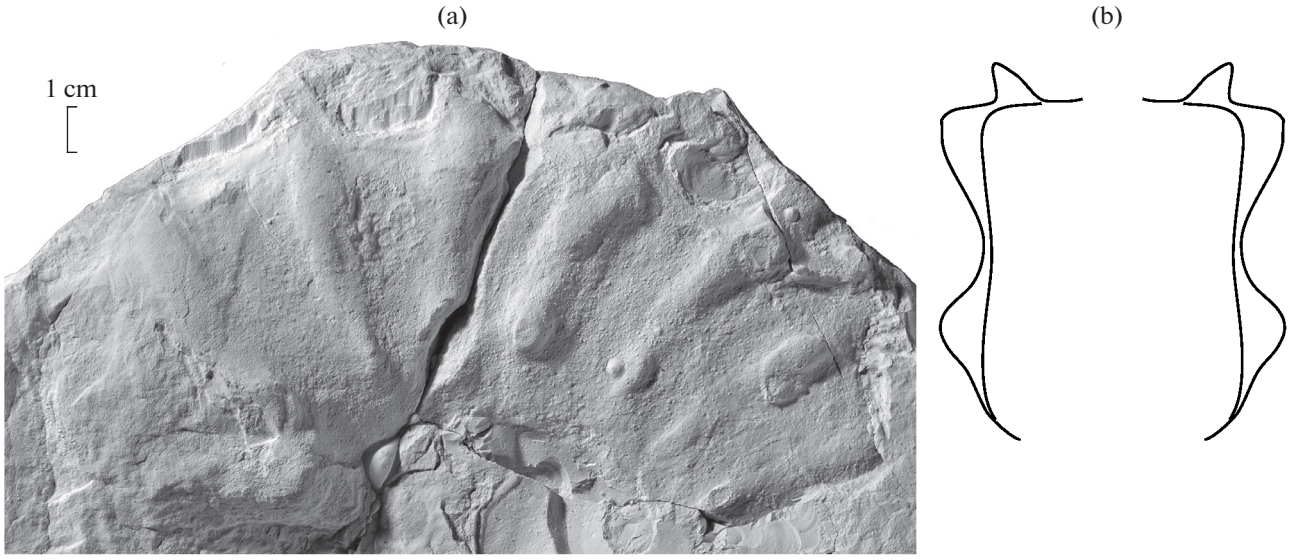

Fig. 3. *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.), specimen no. 149/7: (a) lateral view, (b) reconstructed section of the shell through the main ribs; ~~Lower~~ Turonian, Member ~~9~~, Aksu-Dere ravine, Bakhchisaray district, Republic of Crimea. Collect~~ions~~ by Fokin, 2023. The specimen is covered with ammonium chloride. Photograph by E.Yu. Baraboshkin.

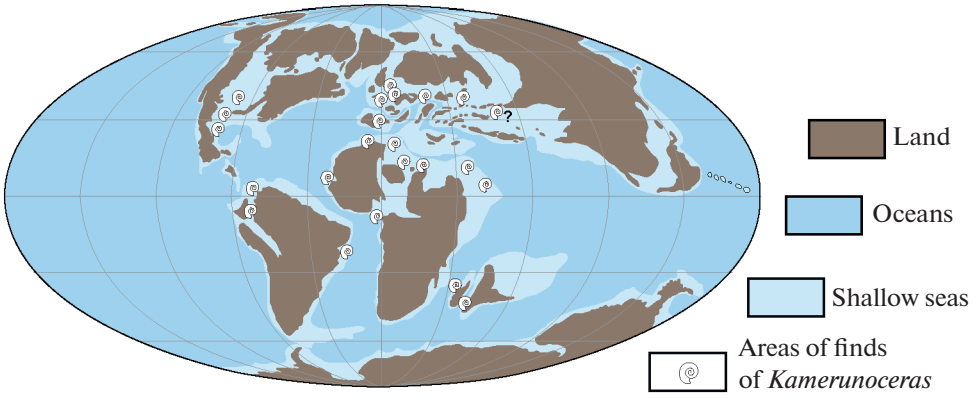

Fig. 4. Scheme of geographical distribution of *Kamerunoceras turoniense* (d'Orb.) on a paleogeographic basis (~~according to~~ R. Blakey, with changes).

division in the General Scale of the Cretaceous System (Olfer'ev and Alekseev, 2002), was accepted. It was proposed to establish the boundary by the first appearance of the ammonite *Collignoniceras woollgari* (Mantell) in the Rock Canyon section near Pueblo, Colorado, which is considered as a limitotype (GSSP) of this boundary (Bengtson, 1996). This level is almost consistent with the appearance of *Kamerunoceras turoniense* (d'Orb.), which was chosen as an index species of the same name subzone of the Collignoniceras woollgari zone for southern Europe (Amedro et al., 2020) and in the General Scale of the Upper Cretaceous of Russia (Olfer'ev and Alekseev, 2002), although it occurs in the upper part of the ~~Lower~~ Turonian (Kennedy et al., 2015).

The Turonian deposits of the southwestern Crimea were long divided into two substages (Naidin, Alekseev, and Kopaevich, 1981; Alekseev, 1989). Later, the possibility of three-~~member~~ division of the Turonian in the Aksu-Dere section was discussed based on microfauna and inocerams (Kopaevich and Walaszczyk, 1990; Kopaevich and Walaszczyk, 1993). The base of the Middle Turonian was conventionally defined along the lower boundary of Member ~~10~~ and the Inoceramus lamarcki Zone, about 18 m above the black shale horizon. In 2016, the boundary between the ~~Lower~~ Turonian and ~~Middle~~ Turonian in the Aksu-Dere section was established about 5 m above the bituminous shale horizon based on nanoplankton (Shcherbinina and Gavrilov, 2016, Fig. 2). At the same time, a certain difficulty of establishing this boundary was noted (Shcherbinina and Gavrilov, 2016, p. 294). According to our measurement of the thickness of the section, the base of Member ~~10~~ (as understood by (Alekseev, 1989)) and, consequently, the base of the Inoceramus lamarcki ~~zone,~~ is about

50 m above the black shale horizon and 15 m above the level of the find of the ammonite (Fig. 2). If our measurements are sufficiently accurate and the information about the occurrence of *Inoceramus lamarcki* (Park.) is correct, the find of *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) refers to the upper part of the ~~Lower~~ Turonian rather than to the base of the ~~Middle~~ Turonian. Obviously, this issue requires additional study of the microfauna.

CONCLUSIONS

The specimen of *Kamerunoceras* sp. ex gr. *turoniense* (d'Orb.) is the first record of a representative of the genus *Kamerunoceras* in sections of Russia; it expands our knowledge of the distribution of this biostratigraphic marker. Although the species *Kamerunoceras turoniense* (d'Orb.) is an index of the samename subzone of the Collignoniceras woollgari zone of the ~~Middle~~ Turonian base, its distribution interval is wider and its stratigraphic position in the Aksu-Dere section indicates the upper part of the ~~Lower~~ Turonian.

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CONFLICT OF INTEREST

The authors of this work declare that they have no conflicts of interest.

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