



New findings of the Bessarabian (Sarmatian) limestones composed of *Nubecularia novorossica* Karrer & Sinzow, 1877 from the village of Tyulenovo and Cape Shabla, NE Bulgaria

Нови находки на бесарабски (сарматски) варовици, изградени от *Nubecularia novorossica* Karrer & Sinzow, 1877, от село ТЮЛЕНОВО и нос Шабла, СИ България

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Introduction

The Bessarabian (Sarmatian) limestones composed almost entirely of *Nubecularia novorossica* tests were first reported from the sections Cape Kaliakra, Bolata Bay and Kamen Bryag (Koleva-Rekalova, Darakchieva, 2017). They are referred to the Odartsi Formation that was introduced by Popov and Kojumdjieva (1987). Further studies have shown that these limestones form a continuous band (along the steep seacoast), which starts from the Cape Kaliakra, continues through the Bolata Bay, the villages of Kamen Bryag and Tyulenovo and reaches the Cape Shabla. The object of the present sedimentological investigation is the limestones, outcropping near the village of Tyulenovo and the Cape Shabla. The main objective is to reveal their macroscopic and microscopic characteristics and correlate with those described in the previous study.

Material and methods

The material came from two new sections from the village of Tyulenovo and the Shabla Cape. The limestones containing *Nubecularia novorossica* were investigated in thin-sections using light transmitting microscope “Zeiss Axioscope 40”. Photomicrographs were taken with a ProgRes GT3 digital camera.

Brief description of the studied sections

The section near the village of Tyulenovo (16 m thick) is composed predominantly of stratified limestones with individual bed thickness varying from 2 to 10 cm, rarely up to 20 cm (Fig. 1a). The limestones are strongly weathered and karstified. They are creamy to reddish in color in cases where they contain red pelitic materials – so-called “terra rosa” resulting from the weathering. On the weathered limestone surfaces the *Nubecularia novorossica* tests are well visible (Fig. 1b). Other macrofossils are represented by rare bivalve shells and single gastropods. Many caves of various sizes and diversified karst forms exist. At the top of the section, dome-shaped bodies about 2 m high and varying in width from 1 to 2 m are located (Fig. 1a). They are composed of creamy in color limestones, which are less weathered but foraminifera tests (*Nubecularia novorossica*) are observed on their upper surfaces.

The section at the Cape Shabla is located near the Monument of Soviet pilots (Fig. 1c). Only dome-shaped bodies, the same as those from the uppermost part of the section Tyulenovo, outcrop here. Their height is up to 2.5 m and their width varies from 1 to 3 m (Fig. 1c).

Results, Discussion and Conclusion

Koleva-Rekalova and Darakchieva (2017) in their study of the same limestones, which outcrop in

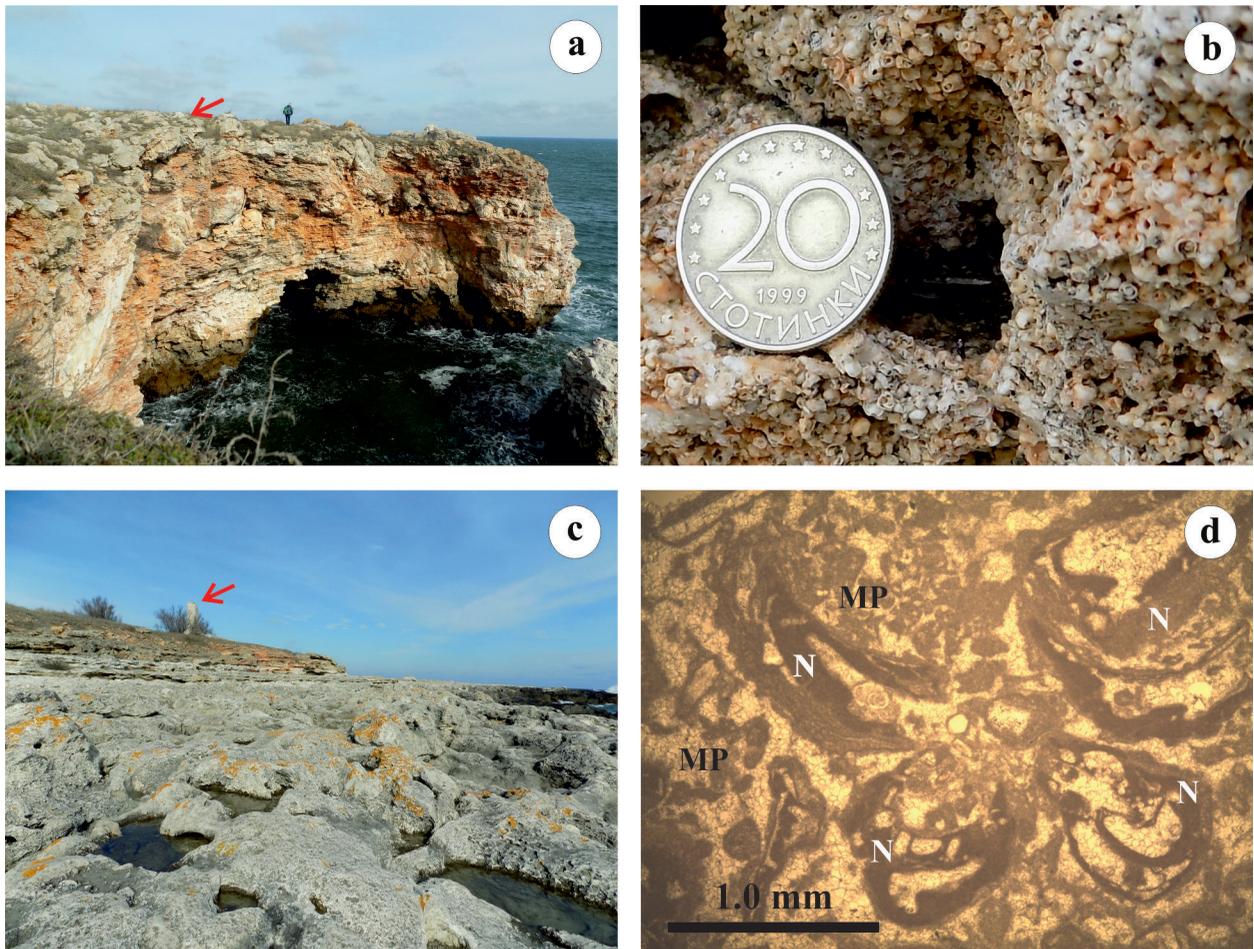


Fig. 1. *a*, stratified limestone containing *Nubecularia novorossica* from the section Tyulenovo (about 16 m thick), dome-shaped bodies (with high around 2 m) are visible in uppermost part (red arrow); *b*, close view of *Nubecularia novorossica* tests on the strongly weathered limestone surface (section Tyulenovo); *c*, dome-shaped bodies (at the front) composed of limestone with *Nubecularia novorossica*, near the Monument of the Soviet pilots (red arrow), section Shabla Cape (three photographs are of N. Dobrev); *d*, photomicrograph of *Nubecularia novorossica nodula* tests (N) and microbial peloids (MP), plane-polarized light, thin-section Sh-01, section Shabla

the sections Cape Kaliakra, Bolata Bay and Kamen Bryag, proved that they contained mainly two forms of *Nubecularia novorossica*: solitaria – single young test with a concave lower surface and a convex upper part and nodula – several tests form nodular aggregates to 2–3 mm in diameter. Macroscopic observations of limestones from the section Tyulenovo show that they are predominantly composed of *Nubecularia novorossica nodula* and rarely of *Nubecularia novorossica solitaria*. Nubeculariid tests are arranged close to each other and are preferably 2–3 mm in diameter (Fig. 1b). The dome-shaped bodies (Fig. 1a) also contain *Nubecularia novorossica*. This is evidenced by the microscopic examination of the dome-shaped bodies at the section Cape Shabla (Fig. 1c). The tests of *Nubecularia novorossica nodula* are the prevailing

component (Fig. 1d). Microbial peloids (consist of cyanobacteria) as well as encrusting red algae and bryozoans are also found in some thin sections.

The described dome-shaped bodies are observed only in the sections Tyulenovo and Cape Shabla (Fig. 1a, c). They occupy their upper parts. Principally, cyanobacteria, red algae and bryozoans can form a rigid framework (Frieble, 1994; Piller, Harzhauser, 2005; Cornée et al., 2009; etc.). Thus the studied here dome-shaped bodies represent nubeculariid bioherms.

In conclusion, it can be noted that the Bessarabian (Sarmatian) limestones, composed predominantly of *Nubecularia novorossica*, outcrop along the Black Sea Coast from the Cape Kaliakra to Cape Shabla. The nubeculariid tests are represented by *Nubecularia novorossica nodula* and rarely by

Nubecularia novorossica solitaria forms. The limestones possess a stratified character in the previously described sections Cape Caliakra, Bolata Bay and Kamen Bryag (Koleva-Rekalova, Darakchieva, 2017) as well as in the studied here section Tyulenovo. The dome-shaped bodies (nubeculariid bioherms) are observed only in the uppermost part of the section Tyulenovo and in the section Cape Shabla.

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References

- Cornée, J.-J., P. Moissette, J.-P. Saint Martin, M. Kázmér, E. Tóth, Á. Görög, A. Dulai, P. Müller. 2009. Marine carbonate systems in the Sarmatian (Middle Miocene) of the Central Paratethys: the Zsámbék Basin of Hungary. – *Sedimentology*, 56, 1728–1750.
- Friebe, J. G. 1994. Serpulid-bryozoan-foraminiferal biostromes controlled by temperate climate and reduced salinity. – *Facies*, 30, 51–62.
- Koleva-Rekalova, E., S. Darakchieva. 2017. First data on the presence of *Nubecularia novorossica* Karrer & Sinzow, 1877 in the Bessarabian limestone of the Odartsi Formation (Northeastern Bulgaria). – In: *Proceedings of the National Conference “GEOSCIENCES 2017”*. Sofia, Bulg. Geol. Soc., 49–50.
- Piller, W. E., M. Harzhauser. 2005. The myth of the brackish Sarmatian Sea. – *Terra Nova*, 17, 5, 450–455.
- Popov, N., E. Kojumdjieva. 1987. The Miocene in Northeastern Bulgaria (lithostratigraphic subdivision and geological evolution). – *Rev. Bulg. Geol. Soc.*, 48, 3, 15–33 (in Bulgarian with English abstract).