



Topola Formation, Northeastern Bulgaria – biostratigraphical and palaeoecological aspects

Тополска свита, Североизточна България – биостратиграфски и палеоекологички аспекти

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Geological setting

The Neogene sedimentary rocks built a significant part of the NE Bulgaria. They fill the shallow inland Varna-Balchik Bay of the Euxinian Basin according to the structural and palaeogeographical regions distinguished by Kojumdjieva and Popov (1981). Popov and Kojumdjieva (1987) introduced 7 formal and 2 informal Miocene lithostratigraphical units in the studied area (Fig. 1A).

The sediments of the Topola Formation crop out as a narrow band along the Black Sea Coast, starting from the village of Kranevo, through the town of Balchik and ending west of the Cape Kaliakra. Inlands, these sediments were found in some drill-cores during the exploration of the Dobrudja Coal Field. A section Zelenka was investigated in detail (Fig. 1A, B).

Description of the section

It can be followed along the cliff from the area of Zelenka, SE of the village of Balgarevo. The studied section starts with an interval (1.2 m thick) consisting of irregular alternation of thin layers from 2 to 10 cm in thickness (Fig. 1B). They are composed of pale yellow (2.5Y8/3) (samples Z1-1 and Z1-3) and light brownish gray (2.5Y6/2) (sample Z1-2) aragonitites. Two serpulid bioherms of spheroidal (40×40 cm, sample Z1-S1) and slightly ellipsoi-

dal (20×26 cm, sample Z1-S2) shape are observed in the interval. Above this interval, a 40 cm thick bed of light gray (2.5Y7/1) solid micrite limestone, containing bivalves (sample Z1-4), exists. In some places it is strongly weathered. A further 1.2 m thick interval is also composed of irregularly alternating thin-layered pale yellow (2.5Y8/3) (sample Z1-5) and light brownish gray (2.5Y6/2) (sample Z1-6) aragonitites. Several semi-vertical tectonic cracks (2–3 cm thick and with a maximum length of 60 cm) start from the top of the interval. They are filled with gray material. The aragonitites are covered with a 10 cm clay bed (sample Z1-7). It is composed of three interbeds of different colors: the lower is gray (5Y6/1), the middle is light olive gray (5Y6/2) and the upper is dark gray (5Y4/1). Upwards, laminated pale yellow (sample Z1-8) and light brownish gray aragonitites with a total thickness of 1.5 m are observed. The section ends with a 60 cm interval, also composed of laminated aragonitites, but showing a slightly positive relief. Some of the laminae are white in color (2.5Y8/1) (sample Z1-9).

Results and discussion

The section is composed predominantly of aragonite sediments (aragonitites according to Koleva-Rekalova, 1994). In its lower part they are thin-layered and above the clay bed they show laminated appear-

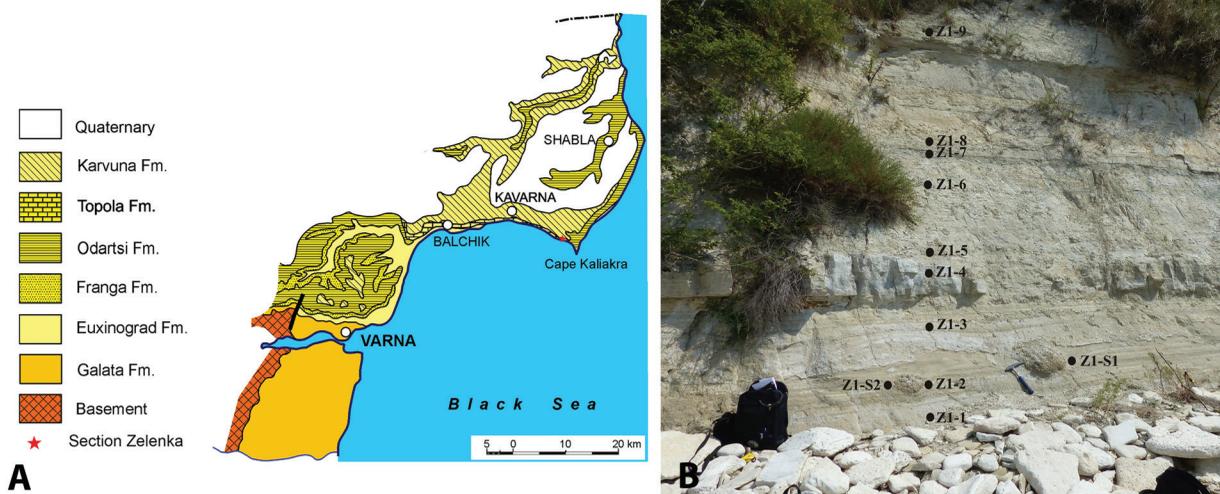


Fig. 1. *A*, geological map of the area, showing the distribution of the Neogene formations in NE Bulgaria (according to Cheshitev, Kanchev, 1989); *B*, the investigated outcrop from the section Zelenka, SE of the village of Balgarevo

ance. The carbonate content of pale yellow aragonites is 94.3% (sample Z1-1) and of light brownish gray aragonites is 92.3% (sample Z1-2). Some white laminae contain only aragonite crystals. The shape of aragonite crystals is mostly needlelike. The maximum length of the needles is up to 0.03–0.04 mm. Single and tiny dolomite rhombohedra are observed in sample Z1-2 (light brownish gray aragonite). The insoluble components (5.7% and 7.7%) are represented by clay minerals and rare quartz grains with sizes less than 0.02 mm. In clay varieties (sample Z1-7) diatoms, clay minerals, quartz grains and organic matter predominate, whereas aragonite crystals are very rare. The limestone is composed mainly of micrite with single ostracods and bivalve fragments (micrite mudstone).

Diatom analysis was performed for the clayey sediments (sample Z1-7). Species characteristic for the association of the *Achnanthes baldjikii* var. *podolica* Subzone were indicated: *Achnanthes baldjikii* (Bright) Grun., *Achnanthes baldjikii* var. *podolica* Miss., *Campylodiscus fastuosa* var. *baldjikiana* (Grun.) Van Landingham, *Navicula palpebralis* var. *semiplena* Greg., *Grammatophora hungarica* Pant., *Cocconeis scutellum* var. *inaequalipunctata* Miss., *Navicula cancellata* Donk. Its stratigraphic range is within the Sarmatian (Bessarabian) (Temniskova-Topalova, 1990). The ecological preferences of the fossil diatom flora indicate marine-brackish origin of the investigated clay sediments, a relatively stable, shallow water environment and moderately low nutrient concentrations.

The fossil mollusc fauna is poorly preserved, as mainly fragments or rare whole shells were re-

corded. Therefore, we follow the rules of the “open nomenclature” for the established mollusc specimens. Apart from these problems the determined mollusc fauna could be related to the community *Obsoletiforma michailowi* – *Inaequicostata barboti* and community *Obsoletiforma balcicense*. The layers of the investigated section, containing this mollusc fauna, can be referred to the upper part of the *Cryptomacra pesanseri* Interval Zone and the local *Obsoletiforma balcicense* Range Zone (according to the local scheme of Kojumdgieva et al., 1989).

Communities with dominant forms including *Obsoletiforma michailowi* (Toula), *O. desperata* (Koles.), as well as the characteristic species *O. gatuevi* (Koles.), *Plicatiforma fittoni rustovenski* (Sultanov), occupied the clayey and calcareous clayey areas of the basin bottom with progressive salinity reduction during the Sarmatian (Bessarabian). A community of *Cryptomacra pesanseri* (Mayer-Eymar) with a relatively small populations inhabited on the deep-sea mudflats. *Inaequicostata barboti* (Hörn.), *I. subfittoni* (Andrus.), *Obsoletiforma michailowi* (Toula), *Atamarcia naviculata* (Hörn.) and a few other species occur as rare.

The established mollusc fauna prefers clayey substrate of marine basin with salinity from 20 to 12‰, and inhabited a depth of waters between 60–200 m. It can bear some fluctuations in temperatures as well as the extent to which the marine water is saturated with oxygen.

Sedimentological studies, combined with both mollusc fauna and diatom flora evidence a relatively

shallow marine environment during the deposition of the aragonite sediments of the Topola Formation.

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