



Taxonomical analysis of the diatom flora from the Topola Formation, NE Bulgaria

Таксономичен анализ на диатомейната флора от Тополската свита, СИ България

Nadja Ognjanova-Rumenova
Надя Огнянова-Руменова

Geological Institute, Bulgarian Academy of Sciences, Acad. G. Bonchev Str., Block 24, 1113 Sofia;
E-mail: nognjan@geology.bas.bg

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Geologic setting

The western border of the vast Euxinian Basin is situated in the Northeastern Bulgaria. Kojumdgieva and Popov (1981) distinguished four structural and palaeogeographic regions within this area. They introduced seven formal and two informal lithostratigraphical units for the Miocene Series of the realm (Popov, Kojumdgieva, 1987). The studied material was collected from the clayey sediments related to the Topola Formation, originated in the shallow inland Varna-Balchik Bay. The Topola Formation consists of aragonite sediments and clayey aragonites with massive and laminated structures (Koleva-Rekalova, 1994). They are interbedded with hard micritic limestones, dolomicrites, as well as diatom-spongolithic clays and silty clays. The thickness of the formation is 45–90 m, the chronostratigraphic range: Upper Bessarabian-Lower Chersonian stages, Sarmatian s.l. (Popov, Kojumdgieva, 1987).

The investigated outcrop is located along the cliff from the area Zelenka, SE of the village of Balgarevo. Detailed description of the studied section is published in Yaneva et al. (2019). Fossil diatoms are determined in the uppermost clayey sediments, whereas the aragonite crystals are very rare.

Previous investigations

The fossil diatom microflora from sediments in the area of the town of Balchik, NE Bulgaria, has been the subject of previous investigations. These deposits have been known to the diatomists for about 150 years, and new fossil diatom species were es-

tablished in the classical phycological works. From this early period of investigations, 54 species and varieties of diatoms are known, among which a great number of new species named after Balchik. Descriptions, critical notes and revisions on certain fossil diatom species from the materials of this area, hosted in different European Diatom Collections, are presented in Hustedt (1927–1966), Ross (1963), Temniskova-Topalova and Economou-Amilli (1989) and Ognjanova-Rumenova and Buczkó (2015). Several interesting species have been revised and new species belonging to the genera *Amphora* Ehrenb. ex Kütz. and *Diploneis* (Ehrenb.) Cleve have been described (Droop, 1998; Levkov, 2009).

Results

The diatom assemblage is abundant and diverse. The total number of diatom taxa recorded in the clayey sediments from the studied outcrop was 82. They were referred to 29 genera, belonging to three classes: Coscinodiscophyceae, Fragilariophyceae and Bacillariophyceae. Five forms could not be identified beyond the generic level, and they were listed as “sp.” In terms of taxonomic diversity, the classes Fragilariophyceae and Bacillariophyceae prevailed. The greatest species diversity was identified within genus *Caloneis* Cleve., *Achnanthes* Bory sensu lato, *Rhopalodia* O. Müller, *Grammatophora* Ehrenb., *Licmophora* C.A.Ag., *Amphora* Ehrenb. ex Kütz., *Campylo-discus* Ehrenb. ex Kütz., *Cocconeis* Ehrenb., and *Diploneis* (Ehrenb.) Cleve (Fig. 1 A–H).

Dominant species is *Caloneis liber* var. *zagrebiensis* Jurilj (Fig. 1E). This species was described from Sarmatian sediments in the vicinity of the town of Zagreb by Jurilj (1957). More of the frustules are badly preserved and only their fragments could be described. Valves are elongate to elongate-elliptical, with rounded apices – sometime slightly protracted. Valves are 121.38–154.7 μm long and – 26.8–30.94 μm wide. Striae are fine, almost parallel in the centre, slight convergent at the ends. They are transverse and crossed by longitudinal lines about half-way between the raphe and the margins. The raphe is straight, the axial area is broadly lanceolate, widening towards the large elliptical central area.

During the last decades, many palaeoecological and stratigraphical studies have been carried out, based on synthesis of diatom assemblages from the Varna-Balchik region (NE Bulgaria). Continuous sequences, from series of cores and outcrops,

were studied by Temniskova-Topalova (1994). Temniskova-Topalova (1990) established local diatom biostratigraphic zones and correlated them with mollusc, foraminiferal and ostracod zones. The stratigraphic distribution of index taxa has been traced within the boundaries of the Eastern and the Central Paratethys (Kozyrenko, Temniskova-Topalova, 1990; Olshtynskaya, 2001). Species characteristic for the association of the *Achnanthes baldjikii* var. *podolica* Subzone have indicated: *Achnanthes baldjikii* (Bright) Grun., *Achnanthes baldjikii* var. *podolica* Miss., *Campylodiscus fastuosus* var. *baldjikiana* (Grun.) Van Landingham, *Navicula palpebralis* var. *sempilena* Greg., *Grammatophora hungarica* Pant., *Cocconeis scutellum* var. *inaequalipunctata* Miss., *Navicula cancellata* Donk. Its stratigraphic range is within the Sarmatian Stage (Bessarabian Substage) (Temniskova-Topalova, 1990).

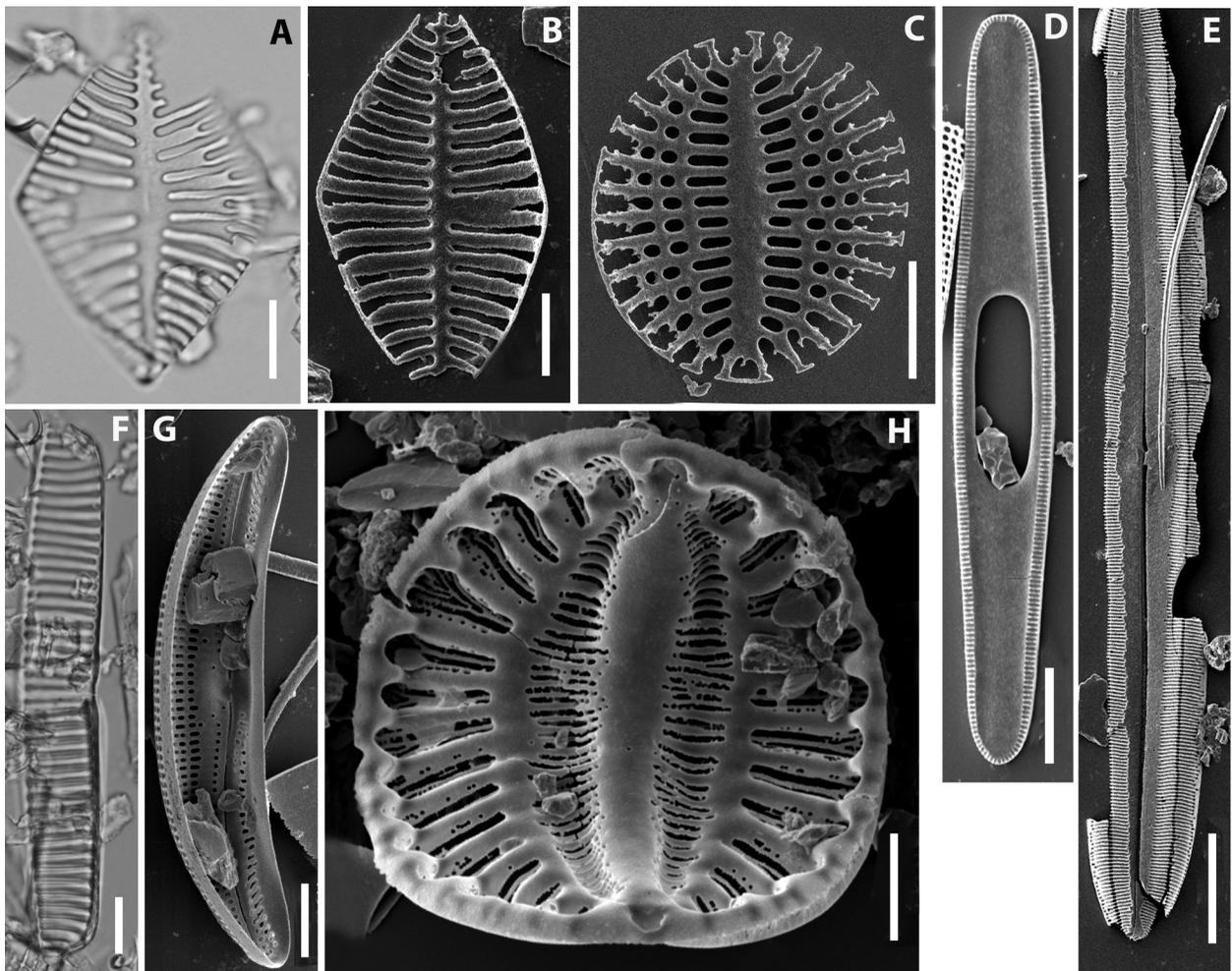


Fig. 1. Most common diatom taxa from the diatom bearing sediments, Topola Formation: A, *Achnanthes baldjikii* (Bright) Grun.; B, *Achnanthes baldjikii* var. *podolica* Missuna; C, *Cocconeis scutellum* var. *inaequalipunctata* Missuna; D, *Grammatophora insignis* Grun.; E, *Caloneis liber* var. *zagrebiensis* Jurilj; F, *Navicula cancellata* Donkin; G, *Amphora ognjanovae* Metzeltin et Levkov; H, *Campylodiscus fastuosus* var. *baldjikiana* (Grun.) Van Landingham

The ecological preferences of the established diatoms indicate marine-brackish origin of the investigated clayey sediments. The appearance of a few freshwater (oligohaline) forms of the genus *Fragilaria* Lyngbye sensu lato and single *Aulacoseira* frustules confirms an influx of freshwater sources and indicates the conditions of reduced salinity. The diatom flora is primarily littoral and sublittoral, with diverse epiphytic and benthic taxa, belonged to class Fragilariophyceae and class Bacillariophyceae, which is indicative of marginal marine environment. The abundance of the broken specimens, particularly of the larger forms, could be a result of a pressure from adjacent sand grains in the matrix.

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