

PONTIAN LACUSTRINE REGIMES AND MARINE INGRESSIONS IN THE STRYMON AREA, NORTHERN GREECE

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Abstract: Neogene diatom-bearing marls are traced in the southeastern parts of the Serres graben possibly passing into the Drama graben. A rich diatom *Aulacoseira* assemblage is referred to the Pontian Stage. Occurrence of several calcareous nannofossil species (with mass presence of *Scyphosphaera globulata*, Zone NN11-12) indicates a periodic influx of marine waters within the coastal lakes of the northern Peri-Aegean.

Key words: Serres graben; diatoms; calcareous nannofossils; Pontian

Neogene stratigraphy

The Serres and Drama grabens belong to the Strouma/Strymon fluviolacustrine system, and being next to the sea coast have been partially invaded by marine waters (e.g., Gramann & Kockel, 1969; Karistineos & Georgiades-Dikeoulia, 1986; Syrides, 2000).

The stratigraphy of the Neogene sediments has been subject of detailed studies. Differences in the stratigraphic schemes (references in Syrides, 2000 and Zagorchev, 1992) are due mostly to lateral facies changes, and to the impossibility to trace marker levels over the whole territory of the grabens. Miocene deposits have been proven in the Serres graben whereas lacustrine deposits in the Drama graben have been referred up to now to the Pliocene.

The stratigraphic scheme accepted here (Fig. 1) follows correlations (Zagorchev 1992) made on the basis of the above-cited studies and detailed published (IGME, 1984-1988) geological maps on the scale 1:50000. Being based upon mammals, foraminifers, megafloora and diatom algae biostratigraphic schemes, the chart is to some extent a compromise between the different views. Some important points may be raised. Thus, most of the Lefkon Formation should be referred to the Maeotian and (partly) Pontian Stage. The mass presence of granite pebbles in Lefkon 4 could be correlated with the unroofing of the young (Late Cretaceous and Palaeogene) granite plutons in the Pirin horst in Pontian times. We are following the opinion of Gramann & Kockel (1969) about a single marine ingression (Maeotian – Pontian Dafni beds, Pontian to lowermost Pliocene? Choumnikon beds) in the graben. The possibility of a second

more restricted Pliocene ingressions (Syrides, 2000) is still not supported with sufficient evidence (Dermitzakis & Georgiades-Dikeoulia, 1987; Popov & Neveeskaya, 2000).

The marly beds studied have been traced (Fig. 2) in the southern and eastern parts of the Serres graben (Zagorchev, Ognjanova, 1995). Additional outcrops along the roads Nea Zihni – Drama (locality **3**) and Rhodolivos – Kavala (locality **2**) have been recently sampled, and the diatom algae determined allow for a correlation of all these outcrops, and with the diatomites of the Baldevo Formation (**5, 6**) in the Gotse Delchev graben (Figs. 1 & 2). The marls (corresponding to the Choumnikon beds) cover directly the Maeotian marine limestones at Palaeokomi (Beratis, Kojumdjieva, 1988), the basal conglomerates in the Amphipolis section (locality **1**), and unknown formations in the other localities.

Diatom algae

In total, 54 diatom species and subspecies taxa were recorded. They belong to 22 genera, 15 families and 6 orders of the classes Centrophyceae (20.3% of the diatom flora; *Aulacoseira ceretana* Haworth & Sabater widespread and dominant) and Pennatophyceae (79.6% but with “rare” or “frequent” species). The most striking feature is the almost monotaxonic composition of the flora in contrast to more diverse diatom nonmarine Neogene floras from South Bulgarian deposits (Temniskova-Topalova, Ognjanova-Rumenova, 1997). Most of the species (83.4%) occur from the Miocene to now, and 16.6% are fossil ones. The monotaxonic community structure is composed of species that belong to genus *Aulacoseira* Thw.

The simultaneous development of planktonic species of the genera *Aulacoseira*, *Ellerbeckia*, *Melosira*, *Stephanodiscus* and *Mesodictyon* (class Centrophyceae) proves the Late Miocene (Pontian) age of the sediments (Ognjanova-Rumenova, 2000). This is confirmed by some of the subdominants related to class Pennatophyceae, as *Fragilaria leptostauron* var. *fossilis* (Pant.)Reh., *F. leptostauron* var. *amphitetras* (Grun.)Reh., *F. leptostauron* var. *trigona* (Krasske)Lange-Bert. et Willmann and *Navicula arata* (Grun.) DeToni.

Most of the identified taxa (66.7%) are with known ecology and are used for palaeoenvironmental interpretation. Planktonic species are only 14.3%, but they are more abundant than the periphytic ones. In terms of the active reaction of the water the largest group is the alkaliphilous species (66.7%), followed by indifferent (17.8%) and alkalibiontic (15.5%). According to the halobion system the oligohalobous taxa are predominant (94.2%). Only three species (occurrence in **1, 2** and **3**) are marine, and namely, *Pyxidicula turris* (Grev. et Arnott) Streln. et Nik., *Aulacodiscus* sp. and *Actinoptychus senarius* (Ehr.) Ehr. The eutrophic species *Fragilaria brevistriata* Grun., *F. construens* (Ehr.)Grun., *Naviculla scutelloides* W.Sm., *Cocconeis neodiminuta* Krammer appear as subdominant in the

association.

The physico-chemical spectra analysis indicates that the diatom assemblage was deposited in a shallow eutrophic lake with alkaline waters and high planktonic diatom productivity.

Calcareous nannofossils

The presence of calcareous nannoplankton in the Choumnikon beds of the Serres graben has been indicated only by Popov & Neveeskaya (2000) who cite *Braarudosphaera bigelowi* Gran & Braarud) Deflandre and the calcareous dinocyst *Perfocalcinella fusiformis*. A richer but still very restricted assemblage has been determined in our samples (localities **1** and **2**). The mass presence of *Scyphosphaera globulata* Bukry & Percival (NN11-12; Maeotian - Pontian) and the occurrence of *Pontosphaera syracusana* Lochmann, *Pontosphaera discopora* Schiller, *Thoracosphaera tuberosa* Kamptner and *Syracosphaera pulchra* Lochmann indicates a most shallow marine environment or periodic influx of marine waters within the coastal lakes. *S. globulata* has been also recently found in the marine Miocene (NN11) of the Ionian zone. Another interesting fact is the exotic occurrence (redeposition) of the Early Cretaceous *Nannoconus steinmanni steinmanni* Kamptner (point **4**) interpreted as a marker for the provenance from the uppermost parts of the Strouma/Strymon fluviolacustrine system.

Correlations and conclusions

The considerable extent of Late Miocene (Pontian) deposits containing the taxa determined points at the existence of large coastal lakes in the Serres and Drama basins. Frequent invasions of marine waters into the coastal lakes are indicated by the calcareous nannofossils. Close correlations between the diatom algae of the coastal basins and the Gotse Delchev graben (**5**, **6**) indicates a direct link between the Strouma/Strymon and Mesta/Nestos fluviolacustrine systems in Pontian time.

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Figure captions

Fig. 1. Correlation of zonal schemes (based on the International Geological Timescale and on different publications on the Mediterranean and Paratethys Neogene) and columnar sections (after Zagorchev, 1992, and references in Syrides, 2000) for the principal grabens in the southern parts of the Strouma/Strymon and Mesta/Nestos fluviolacustrine systems.

Fig. 2. Sketch map for the southern parts of the Strouma/Strymon and Mesta/Nestos fluviolacustrine systems in Neogene and Quaternary times.



