



Palynological analysis in the Upper Miocene core from the Pannonian Basin of Croatia

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The total of 42 samples was taken from the cored interval 816.0 – 860.7 m (44.7m) of the well Šandrovac-184 (Ša-184). The borehole is located in northern Croatia about 80 km eastward from Zagreb. Sediments are represented by fine to medium grained litharenite, micaceous siltstones (sporadically argillaceous) and silty marls. The selected part of the studied samples was dated as the Pontian stage of the Upper Miocene series according to the dinoflagellate cysts. Finding of the species *Spiniferites balcanica* biostratigraphically classifies this interval into the *Spiniferites balcanica* organic-walled microplankton main zone (Sütő-Szentai, 1988). Furthermore, discovery of the *Spiniferites paradoxus* (COOKSON & EISENACK 1968) SARJEANT 1970, *Millioudinium pelagicum* SÜTŐ-SZENTAI 1990, *Millioudinium foveolatum* SÜTŐ-SZENTAI 1982, *Impagidinium spongianum* SÜTŐ-SZENTAI 1985, *Impagidinium globosum* SÜTŐ-SZENTAI 1985 indicate the Lowermost Pontian zone *Spiniferites bentori coniunctus* – *Spiniferites paradoxus* (Sütő-Szentai, 1988). In 37 out of 42 palynological slides, fossil pollen was suitable for exploration and counting. The pollen spectrum in the studied sediments contains mostly inaperturate pollen grains of Taxodiaceae (30.8%), Taxaceae (10.3%) and Cupressaceae (16.8%), bisaccate pollen of *Pinus*, as well as other poorly preserved pollens of Pinaceae (30.4%).

Percentage of the remaining pollen taxa is low : *Abies* (3.9%), *Alnus* (2.1%), *Tsuga* (4.1%), *Betula* (0.7%), *Carya* (0.4%), *Juglans* (0.4%), *Myrica* (<0.1%), *Pterocarya* (<0.1%), *Tilia* (<0.1%) and Cichorioideae (<0.1%). Spores (3.3%) and Algae (6.1%) are not abundant in the samples. Rate of the indeterminable pollen grains is relatively high (11.2%). Pollen taxa have been sorted into the 3 different groups based on eco-

logical criteria: subtropical Taxodiaceae, Cichorioideae, and *Myrica*; warm-temperate *Carya*, *Acer* and *Juglans*; and middle-altitude and high-altitude trees Taxaceae, *Abies* and *Tsuga*. The other taxa (Pinaceae, Cupressaceae, *Tilia*, *Betula*, *Alnus* and *Pterocarya*) can be found in all specified climatic environments. According to these data, pollen synthetic diagram has been made. In the studied interval, based on the pollen data, the mean annual temperature has been estimated, using the “climatic amplitude method” (Fauquette et al., 1998a). Along the entire interval, estimated values of mean annual temperature are between 10 – 20°C, mostly 15°C. Diagram of the variations in concentration of Pinaceae pollen together with dinoflagellate cysts has been a useful tool in recognizing and characterizing the eustatic changes. Based on the results of the pollen spectra, three pollen zones have been established: Z₁ (860- 835m), Z₂ (835-825m) and Z₃(825-816m). The paleo-vegetation, according to the high percentage of trees in the pollen spectra, is typical for forests and could be grouped in the three different environments: (1) coastal, swamp environment characterized by megamesothermic (subtropical) elements with Taxodiaceae as the most important component and mean annual temperature of approx. 20°C; (2) mid-altitude forest characterized by pollen grains of *Tsuga* and mean annual temperature of approx. 10°C; and (3) high-altitude forest designated by pollen grains of *Abies*. Consequently, during the Upper Miocene, in this area existed fairly developed swamps weakly influenced by the mid to high-altitude forest. The climate was warm and humid.

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