



Micropaleontological proxies of Mid-Cretaceous environments: a high-resolution analysis of black- and red-beds in the Carpathian sections

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Mid- to Late Cretaceous changes in global oceanic regime led to the reddish colored deep-sea pelagic deposition in the Carpathian basins, as well (Puchov Marls *sensu* Stur 1860). However, in contrast to the anoxia concept of mid Cretaceous deep oceanic waters, red coloured sediments produced in well oxygenated environment appeared here as early as during Albian (*Rotalipora ticinensis* Zone) and continued during the Cenomanian. The red beds recorded short-timed fluctuations in composition of foraminiferal associations, mainly in ratio of opportunists (e.g. hedbergellids, whiteinellids, etc.) and keeled foraminifers (e.g. rotaliporids, dicarinellids). Distribution of these inhabitants depends on productivity changes in surface or intermediate waters. Generally, the foraminifers living in the thermocline (deep sea dwellers) and adapted to oligotrophic feeding mode (large keeled rotaliporids) gradually increased to the maximum in the *Rotalipora greenhornensis* and *R. cushmani* Zones. This trend in foraminiferal strategies indicates a thermal stratification of water column due to input of cold and oxygenated polar waters into oceanic depths.

The major turn in red marl microfauna composition happened at the Cenomanian/Turonian boundary when the rotaliporids disappeared in the planktonic foraminifer spectrum. The decline of this fauna was caused by general reorganization of the latest Cenomanian oceanic regime, when the thermocline became unstable due to climate warming and subsequent water column homogenization. The rotaliporids settled in deeper part of the water column were exposed to larger ecological stress accompanying the expansion of Oxygen minimum zone up to thermocline. Un-

stable environmental conditions during the Cenomanian/Turonian transition are also recorded by increase of biosiliceous productivity with predominance of more tolerant radiolarian microfauna (*Spumellaria*). Advancing warming at the end of Cenomanian produced general anoxia recorded in the Bonarelli Bed (OAM 2). Lower Turonian foraminifer association from red marls above extinction horizon of rotaliporids is characterized by whiteinellid and helvetotruncanid opportunistic fauna. Later, dicarinelids and the first representatives of marginotruncanids became appear in greater amount, which indicates return of meso- to oligotrophic conditions. Second interval of red-bed deposition spend over the Campanian/Mastrichtian time (*Globotruncana arca* and *Globotruncana falsostuarti* Zones). There was a time of diversity maximum of the foraminiferal plankton and the dominance of warm water *Globotruncana*-like K-strategists.