Sedimentary cycles of different orders in the Paleocene/early Eocene sequence of the North Caucasus (South Russia)

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In the Paleocene–early Eocene, the North Caucasian area represented a water body differentiated into some basins in which sedimentation types changed through sequential time intervals, forming large sedimentary cycles, each comprised of one or several lithological formations. Danian sediments represented lower Paleocene cycle are made up of rhythmically alternating marls and limestones and are compositionally similar all over the study area. In the early Selandian (the boundary of nannofossil Zones NP4/NP5), a sharp change in sedimentation occurred: in the eastern and central parts of the basin carbonatic and carbonatic-terrigenous sediments accumulated, and in the western part the terrigenous Goriachiy Kluch Fm. was formed. The latter is a non-calcareous sequence lacking visible rhythmicity. By contrast, the sediments of the eastern and central Caucasus show remarkable fluctuations in $CaCO_3$, evidently recording stages of different productivity of calcareous microplankton. Two eustatic cycles have been revealed in the late Paleocene. The top of the lower one (nannofossil Zone NP8) is marked by a clearly visible bed with a maximum $CaCO_3$ content, traceable throughout the northeastern Peri-Tethys (N. Muzylöv, pers. comm). Inside this cycle, the interval with lower $CaCO_3$ (NP6/NP7), evidently corresponding to sea level lowstand separated two cycles of lower order, is established. In the shallower eastern part of the basin (Dagestan), this range contains alternating limestones and more clayey interlayers tens of centimeters thick, forming rhythms of about 120 k.y. in duration (eccentricity cycles?). The significant fluctuations in the proportion of different nannofossil taxa (*Prinsiaceae/Coccolithacea*, *Fasciculithus/Sphenolithus*, a.o.) occur at this level, evidently reflecting changes in nutrient supply. The complexly built upper Paleocene cycle spans NP9-lower NP10(CP8b) and is characterized by sharp lithologic changes in the Paleocene/Eocene boundary caused by onset of the PETM. This event corresponds to vigorous sea level changes of large magnitude and very short duration. As a result of this event, carbonatic sedimentation gave way to organic-rich sediment accumulation, because calcareous microplankton assemblages were replaced by organic-walled ones. This gave rise to a thin sapropelitic bed observable all over NE Peri-Tethys (Muzylöv, 1994; Gavrilov et al., 2003). After the termination of ecological crisis, the calcareous microbiota was entirely recovered for a short time and after that changed to siliceous sediments caused by siliceous plankton outburst in its central part and slightly calcareous sequence with a number of ash layers in the eastern part of the basin (lower NP10 = CP8b). The sharp regression that followed (the boundary of nannofossil Zones CP8/CP9) resulted in a regional hiatus.

The early Ypresian transgression led to restoration of carbonatic sedimentation throughout the North Caucasus, including its western part, where terrigenous sediments accumulated in post-Danian time; the transgression was attended with rapid evolution of nannoplankton. Two Ypresian eustatic cycles are identified based on $CaCO_3$ fluctuations. The lower cycle corresponded to upper NP10(CP9)-NP11 is composed of uniform calcareous sediments in the whole area, and the upper (NP 12-NP13) shows marked rhythmicity. In the eastern part of the basin, the alternating calcareous and more clayey sediments also make up rhythms about 120 k.y. in duration that are characterized by sharp fluctuations in the *Sphenolithus/ Zygrhablithus* ratio – taxa consisted the main part (more than 50%) of nannofossil assemblage. In the central and western parts, this interval contains a number of interbeds rich in organic matter. This suggests significant fluctuations in hydrological conditions, nutrient supply, and consequent changes in microplanktonic assemblages.

Hence, the Paleocene/early Eocene sediments of the North Caucasus provide an insight into the relationships of regional and global factors in the sedimentary process.

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