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The Late Cenomanian Paleoecological Event (OAE 2) in the Eastern Caucasus Basin: sedimentology, geochemistry, and biota

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The late Cenomanian Oceanic Anoxic Event (OAE 2) is readily recognizable in the sedimentary record of the eastern Caucasus basin, which represented a constituent of the northeastern Peri-Tethys. Sediments of the transitional Cenomanian/Turonian interval were investigated in seven sections. Based on the stratigraphic completeness, the sections are divided into three types: (1) sections with complete OAE 2 interval; (2) sections containing only the OM-rich sediments overlain by the middle Turonian limestones; and (3) sections marked by the complete erosion of OAE 2 sediments during the early Turonian transgression. The OAE 2 sediments are characterized by a distinct cyclic structure. The SB comprises 11 or 12 cyclites each up to 15–17 cm thick. The cyclites consist of alternating black marlstones (at the base) and gray clayey limestones. Together with the under and overlying sequences, the sediments rich in OM form a single sedimentary cycle. OM-rich sediments differ from their embedding rocks lithologically, geochemically, and paleontologically: they demonstrate positive $\delta^{13}C$ and negative $\delta^{18}O$ anomalies, elevated concentrations of many minor elements, substantial reorganizations in nannofossil assemblages, disappearance of benthic organisms, a.o. Since some changes are observable already in the underlying layer and extend up to the top of overlying layer, the interval of the OAE 2 seems to be larger than the layer rich in OM.

Variations in the composition of nannofossil assemblages indicate environmental perturbations at the Cenomanian/Turonian transition. The increased relative abundance of cool-water species suggests relative cooling during OAE 2. At the same time, negative oxygen isotope excursion indicates relative warming or desalination of the basin. Widest occurrence of opportunistic *Watznaueria* spp., which are tolerant to changes in temperature, trophication and salinity, might suggest decreased salinity during this event.

The formation of elementary cyclites evidently correlates with the Milankovitch precession cycles (~21 ka). The number of cyclites suggests that the duration of periods corresponding to the accumulation of OM-rich sediments was 230–250 ka, whereas the entire OAE 2 sequence in the most complete section accumulated during ~370–410 ka. Thus, the formation of the whole sedimentary cycle embracing all OAE 2 sediments likely corresponds to a single ~400 ka long eccentricity cycle or a complex of precessional cycles.

The lithological and geochemical characteristics of OM-rich sediments imply the intermittent anoxic environment in the basin that involved insignificant part of the water column (mostly, bottom water layers). The role of anoxia in the accumulation of organic matter was not dramatic. OM-rich sediments were deposited during a rapid eustatic transgression, when basin waters became highly enriched with biophile elements transported from flooded coastal landscapes that stimulated the rapid growth of phyto- and bacterioplankton productivity and caused the accumulation of OM-rich sediments. The nonlinear development of the transgression resulted in the irregular influx of biophile elements to the basin affected the formation of cyclic sequences.

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