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OAE 2 and PETM anoxic events in northeastern Peri-Tethys: similarities and differences

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A series of global events related to wide occurrence of anoxic environment are detected in sedimentary record of epeiric basins of northeastern Peri-Tethys. The most pronounced among them are latest Cenomanian OAE 2 and Paleocene-Eocene Thermal Maximum (PETM). The repercussions of OAE 2 were studied in seven sections of different paleogeographic settings in Crimea and Caucasus, and PETM manifestations were found and analyzed in 13 distant sections in huge area (about 3,000 km WE) from Crimea to Central Asia.

Both events are characterized by wide accumulation of sediments rich in TOC. In OAE2 sediments TOC values vary from 5 to 10% in the eastern Caucasus, reach up to 20% in the western Caucasus and consist 6-10% in Crimean sections. TOC values in PETM sediments range 1-10% in Caucasus and reach up to 25% in Central Asia.

Sedimentary records of both events display pronounced cyclicity in TOC distribution. Each band (0.1-0.25 m) is composed of dark TOC-rich lower layer and pale more calcareous upper layer and their contrasting can be very distinct. The band number in the OAE 2 and PETM records is different: the first event incorporates up to ten cycles, while second event comprises not more than four cycles. If this sedimentary cyclicity is caused by precession cycles, the duration of TOC-rich sediment accumulation during OAE 2 ($\sim$ 200 k. y.) appears to be much longer than the episode of TOC accumulation during PETM ($\sim$ 40-50 k. y.). Within each band, pyrolysis revealed the domination of basinal organic matter in the dark layers and higher amount of terrestrial organic matter in the pale layers.

Both events were preceded by significant sea-level falls marked by occurrence of relatively shallow-water sediments or hiatuses and TOC-rich sediments in both cases accumulated during rapid large-scale transgressions. At the same time, a propagation of sea-level rise had slip-stick character that caused variations in terrestrial runoff and microplankton productivity enabled cyclic pattern of TOC-rich sediment formation.

2 and PETM are featured by large oxygen isotope excursions reflecting dramatic climatic warming. Simultaneously, d13C displays positive excursion corresponding OAE2 and negative excursion during PETM. A response of nannoplankton to climatic and hydrological reorganizations during both events was essentially different in both cases: sediments correlated to OAE 2 include oligotaxonic nannofossil assemblage composed of long-lived euritopic Watznaueria spp., while PETM is characterized by wide occurrence of short-lived highly specified Rhomboaster spp. and asymmetric discoasters.

Significant variations in TOC concentrations throughout the NE Peri-Tethys and cyclic character of sedimentary records of both events enable reasonable assumption of variable level of oxygen depletion through time and space changing from anoxic to suboxic environments in different parts of basin and in different stages of OAE 2 and PETM evolution.

Restricted area of TOC-rich sediment accumulation during PETM comparing to OAE 2 was likely caused by changes in ocean morphology and circulation.

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