

Panthalassic oceanic anoxia at the end of the Early Triassic after the end-Permian mass extinction

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Fossil data show that the recovery of life after the end-Permian mass extinction occurred in the Anisian (early Middle Triassic). The process by which oceanic environments recovered from anoxia after the end-Permian event is uncertain. To determine the timing of known recovery stages, the nature of oceanic redox conditions and the health of cyanobacterial plankton populations, this study analyses conodonts and organic molecules from siliceous claystones and cherts from accretionary complexes in Japan that span the upper Lower Triassic to the lowermost Middle Triassic. Conodonts indicate that the study section ranges from upper Olenekian to Anisian, and includes the Olenekian/Anisian boundary. An increase in polycyclic aromatic hydrocarbons (probably derived from algae dominated organic matter) and a decrease in methylhopane index (2 α -methylhopane/hopane, a measure of cyanobacterial activity) are present in end-Olenekian black chert. Pristane/phytane ratios (a measure of redox conditions) in all stratigraphic units are lower than 1, indicating the prevalence of deep-sea anoxia during the late Olenekian to Anisian. High concentrations of dibenzothiophene (an index of anoxic depositional environments), high sulphur/carbon ratios, and high organic carbon contents are present in two upper Olenekian intervals and at the end of the upper Olenekian, suggesting development of anoxic deep water. One of the anoxic events in the end of the upper Olenekian coincided with decreased radiolarian diversity. This implies that anoxic deep water in the Panthalassic Ocean reached intermediate water depths at the end of the Early Triassic, killing marine organisms including radiolaria. This event may be related to the delay in the recovery of life and environments after the end-Permian mass extinction.