Chemostratigraphic analysis on the Middle Triassic (Anisian) Oceanic Anoxic Events

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Superanoxia across the Permian Triassic boundary, which has a long duration from the late Middle Permian to the early Middle Triassic (about 20 million years), is globally recognized and debated well in the context of the end Permian mass extinction. However, few studies focus on the integrated decoding of the recovery processes in the Anisian from Superanoxia because of limited application of geochemical proxies. To reconstruct the interactions between the environmental factors from multi elemental data, principal component (PC) analysis was performed on the Middle Triassic chemostratigraphy of the pelagic deep sea sequence in the Mino belt, central Japan. Major and trace element concentrations in the samples were determined by X–ray fluorescence spectrometry (XRF). Before PC analysis, the data matrix (438 samples and 20 elements) was normalized for constant sum. As a result, six PCs were statistically accepted and capture 77% of the total variability. The sedimentological interpretations for the components were as follows. PC1 represents the chemical weathering intensity of terrigenous materials. From the time series data of the PC1 scores, a frequency analysis detects dominant sedimentary cycles similar to the Milankovitch cycles. PC2 is the direction along the enrichment of redox sensitive elements. These records indicate astronomical driving force behind the oceanic redox evolution during the Middle Triassic. PC3 might be related to the deposition of the siliceous claystones called the Toishi type lithofacies. PC4 explains the depletion and accumulation of ferromanganese oxides precipitated from seawater across the anoxic event intervals. PC5 might be interpreted as mixing with heterogeneous materials because the scores shows no systematic variations with the lithostratigraphy and a sample with an anomalously high score has a remarkable chemical composition. PC6 might reveal the abundance of biogenic materials. Further non parametric approaches and conodont biostratigraphic correlations would lead to superior paleoenvironmental reconstruction by predicting more precise sedimentological components.