Geochemical characteristics of black shales in the Japanese accretionary complex across the Permian-Triassic boundary extracted by independent component analysis

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The Permian-Triassic boundary (PTB) is characterized by an oxygen-depleted condition in the superocean Panthalassa. However, the degree of the oxygen depletion in deep-sea environments remains an open question.Deep-sea sediments that deposited from the latest Permian to early Triassic constitute black shale within the accretionary complexes of Japan, showing a distinct enrichment of redox sensitive trace metals (e.g., V, Mo, U) that precipitate under reducing conditions.In contrast to the Panthalassa at the PTB, the modern ocean is generally oxygenated from the surface to the bottom due to a sufficiently strong global ocean circulation. However, oxygen-depleted water masses can develop in some specific areas such as restricted basins and coastal upwelling areas, and blackish sediments in these areas show laminated facies and/or high total organic carbon contents reflecting oxygen-depleted conditions.Comparing the black shales at the PTB with the other sediments that deposited in oxygen-depleted conditions can characterize the Panthalassa across the PTB in a context of a broad spectrum of oceanic environmental changes throughout the Earth’ s history. To this end, clarifying geochemical features of multiple elements, especially of redox sensitive trace metals, is quite a useful approach to extract the information of the oceanic environments involving variations in redox conditions. Here we applied independent component analysis to the multi-elemental data set composed of major- and trace-element contents of the samples from the PTB sections within the accretionary complexes of Japan, and black mud and shale of other geological times obtained by scientific drillings in the modern oceans. We will discuss the geochemical characteristics of the PTB black shales and the other blackish sediments, and oceanic environmental conditions across the PTB.

Keywords: Permian-Triassic boundary, black shale, redox sensitive trace metals, independent component analysis, accretionary complex

