

遠洋域深海相におけるペルム紀末大量絶滅時の微量元素の挙動

Trace element behaviors during the end Permian mass extinction at the deep sea floor.

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We describe the variations of trace-elemental compositions that took place in the paleo-super-ocean Panthalassa during the end-Permian mass extinction, based on the sedimentary rock samples from one of the most continuous Permian-Triassic boundary sections of pelagic deep-sea, exposed in the northeastern Japan area. Our measurements show high concentrations of redox-sensitive elements such as Molybdenum (Mo), Vanadium (V), and Chromium (Cr) are present in the Upper Permian to end-Permian strata in the study section.

Vanadium concentration shows two peaks in the section. The first one is in the Changhsingian chert beds without any co-increase of other trace elements. The second one is recognized in the uppermost part of siliceous claystone and the basal black claystone bed which accords the end-Permian mass extinction. Mo shows high concentrations at the upper part of Changhsingian siliceous claystone bed and overlying the base of the black claystone. These Mo concentrations are followed by high Chromium concentrations. The final peaks of Mo coincide with that of V. Above the horizon characterized by high concentrations of V, Mo, and Cr, any significant increase was not detected from the Changhsingian to Induan black claystone. Rapid uptakes of V, Mo, Cr into the sediment require reduction in their valences. The single peak of V from Upper Permian chert beds suggests moderately reduced bottom water conditions, because the first step of reduction of V requires relatively weak reduced conditions. While second-step reduction of V and Mo reduction requires strong reduced conditions. Additionally, reduction of Cr requires moderately reduced conditions which correspond between first-step and second-step reduction of V. Hence, the co-occurrence of high concentrations in Mo and V at the basal black claystone which accords the end-Permian mass extinction suggests maximum reduced conditions at least at the sediment-water interface at that time. Therefore, this line of variations in trace element concentrations indicates a progressive reduced deep-water condition in the central Panthalassa, and the onset of the end-Permian black claystone is characterized by euxinic maxima at the Panthalassic sea floor. Such expanded euxinic deep waters might represent an important causal factor in the end-Permian mass extinction in central Panthalassa.

Keywords: mass extinction, trace element, euxinia, pelagic deep-sea, Panthalassa