

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

TAKAHASHI, Satoshi^{1*}, Shin-ichi Yamasaki², Yasumasa Ogawa², Kazuhiko Kimura³, Kunio Kaiho², Takeyoshi Yoshida², Noriyoshi Tsuchiya²

¹University of Tokyo, ²Tohoku University, ³Miyagi University

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 measurement shows 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. First one is in the Changhsingian chert beds without any co-increase of another trace elements. 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 does 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 suggest moderately reduced bottom water condition, because first step of reduction of V require relatively weak reduced condition. While second-step reduction of V and Mo reduction require strong reduced condition. Additionally, reduction of Cr requires moderately reduced condition which is corresponded 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 suggest maximum reduced condition at least 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