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Early Triassic noxious benthic environments in the South Kitakami terrane, northeast Japan, and their biotic recovery

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The Early Triassic period is considered to be an interval of delayed biotic recovery following the end-Permian mass extinction. The existence of the devastation and its duration were precisely analyzed by studying deep-sea sediments; however, its effects on shelf environments are still obscure. The global distribution of contemporaneous devastated shelf sediments implies the widespread diffusion of a noxious condition in shallow marine environments. Early to Middle Triassic marine sediments (the Inai Group) are known to occur in the South Kitakami terrane (SKT) in northeast Japan. The sedimentary environmental change from fluvial to outer shelf deposited with early Triassic transgression is suggested by previous study (Kamada and Takizawa, 1992). This study aims to reconstruct the sediments deposited on shelf environments from the Spathian to the Anisian period by describing the vertical variations in the ichnofacies (Ichnofabric Index; Bottjer and Droser, 1994) and the chemical composition (using XRF and ICP-MS).

In this study, the ratio of Uranium/terrigenous element, which suggests redox condition in bottom-water, accompanied with the Ichnofabric Index. These proxies suggest that Spathian sediments were deposited in relatively reductive environments that were unfavorable for benthic activity, while Anisian sedimentary environments were more oxic and habitable.

The recent studies of trace fossils and gastropods show that the biotic recovery through

the Early Triassic was not a sudden process; instead, it occurred in a stepwise manner (Twitchett, 1999; Payne, 2005). Moreover, the carbon isotope data gathered from Chinese contemporaneous sediments show that a large perturbation of the carbon cycle occurred not only at the P-T boundary but also during the Smithian and Spathian periods (Payne et al., 2004). In this study, we suggest that noxious conditions existed in the Spathian shelf environments. Therefore, the recovery of the benthic environments in the SKT and global biotic recovery (Twitchett, 1999; Payne et al., 2004) were found to have occurred around the same time.