Middle Permian tectono-sedimentary history with biotic reaction of the Southern Kitakami Terrane, northeast Japan

SHIINO, Yuta [1, *]

[1] Graduate School of Science and Technology, Niigata University, Niigata 950-2181, Japan
[*] y-shiino@geo.sc.niigata-u.ac.jp

Prior to the near-complete elimination of terrestrial and marine biota at the end-Permian, marine shelly biota, mainly benthic animals such as bryozoans, brachiopods, gastropods, bivalves, trilobites and fusulines, suffered severe damage in the Guadalupian Epoch of the Middle Permian, the so-called Guadalupian extinctions (Stanley and Yang, 1994). It has been suggested that the extinction was caused by oceanic anoxia, mode of climatic oscillations, tectonically activated paleogeographical rearrangements and volcanisms, while it still remains controversy. Apart from the geological and climatic arguments, extinction is a manifestation that organisms could not adapt to a newly emerged habitat as a result of environmental changes. Thus understanding the environmental history with biotic reaction could expand our knowledge of the global event of the Middle Permian mass extinction. The aim of this presentation is to exemplify the transition of sedimentary environments and their organism-related responses in the active margin setting of the Middle Permian in the Southern Kitakami Massif (see Shiino et al., 2011).

In the Kamiyasse area, the Middle Permian sequence is subdivided into three formations; the Hoso-o, the Kamiyasse and the Kurosawa Formations in ascending order. The transition in the sedimentary environment began with an upper slope to outer shelf depositional setting that was associated with a river system and thus deposited abundant botanic remains in the Hoso-o Formation. By contrast, the sediments of the overlying Kamiyasse Formation, the base of which is roughly equivalent to the base of the Capitanian, originated from complex depositional sources in the context of fault-related tectonic basins. This is likely due to volcano-tectonic activations in this period, considering the reliable evidence for tuffaceous sand layers. Brecciated reef corals and cemented brachiopods were derived as talus deposits, suggesting a presence of shallower hard substrate environment nearby. This unique depositional setting resulted in the seemingly "mixed" fauna associated with this formation. The depositional environment of the overlying Kurosawa Formation is

similar to that of the Hoso-o Formation, but with many fewer, monotonous biotic remains. Of these, brachiopod *Spiriferella* sp. is suggestive of the cool and swift water environment (e.g., Shiino and Angiolini, 2014). Its exclusive occurrence at the basal part of the formation may lead to a hypothesis of prompting the inflow of cool water upwelling onto the onshore area as a consequence of tectonic activations. Transgression of the sea level may also facilitate the generation of cool water inflow. Such an inflow of cool water could damage benthic organisms, and we interpreted this as a likely scenario for the Guadalupian extinction. A comparatively thick sandstone layer with rhythmical laminations at the base of the Kurosawa Formation may represent such a cool and swift water inflow into the basin.

The lines of evidence presented here may imply that volcano-tectonic activations have brought a wide variety of habitats for benthic animals, resulting in the Middle Permian diversification prior to the Guadalupian extinction. In turn, a new tectonic setting with the aid of transgression caused the inflow of cool and swift water to the basin, the event that enables to wipe out the benthic animals in the Southern Kitakami Terrane.

References

Shiino, Y. and Angiolini, L., 2014, Hydrodynamic advantages in the free-living spiriferinide brachiopod *Pachycyrtella omanensis*: functional insight into adaptation to high energy flow environment. *Lethaia*, **47**, 216-228.

Shiino, Y., Suzuki, Y. and Kobayashi, F., 2011, Sedimentary history with biotic reaction in the Middle Permian shelly sequence of the Southern Kitakami Massif, Japan. *Island Arc*, **20**, 203-220.

Stanley, S.M. and Yang, X., 1994, A double mass extinction at the end of the Paleozoic Era. *Science*, **266**, 1340-1344.