Global perturbations of carbon cycle in the mid-Panthalassa during the Triassic-Jurassic transition

*藤崎 渉[1]、澤木 佑介[2]、松井 洋平[1]、丸山 茂徳[3]
*Wataru Fujisaki[1], Yusuke Sawaki[2], Yohei Matsui[1], Shigenori Maruyama[3]

1. 国立研究開発法人海洋研究開発機構、2. 東京大学、3. 東京工業大学地球生命研究所
1. Japan Agency for Marine-Earth Science and Technology, 2. Department of Earth Science and Astronomy, University of Tokyo, 3. Earth-Life Science Institute, Tokyo Institute of Technology

The biodiversity crisis across the Triassic-Jurassic boundary (T-JB; *ca.* 201 Ma) has been regarded as the one of the biggest mass extinctions in the Phanerozoic life history. Extinction-related environmental changes across the T-JB occurred concurrently with significant perturbations in carbon cycle, as mirrored by a complex pattern of the positive and negative carbon isotope excursions in the fossiliferous shallow-marine strata deposited along continental margins. These investigations of the carbon-cycle reconstruction across the T-JB emphasized the causal relationships between the Central Atlantic Magmatic Provinces (CAMP) volcanism and T-JB event. However, the deep mid-Panthalassa, which occupied major portion of the global ocean at the Triassic-Jurassic transition, has not been much focused in reconstructing carbon cycle. Understanding global carbon cycle associated with the CAMP volcanism in the mid-Panthalassa across the T-JB, we determined the $\delta^{13}C_{org}$ values from Rhaetian (Late Triassic) to Hettangian (Early Jurassic) shales interbedded within deep-sea cherts at Katsuyama section in Inuyama area, Mino-Tanba belt, SW Japan.
A high-resolution Rhaetian to Hettangian $\delta^{13}C_{org}$ values in the mid-Panthalassa contain three distinct negative carbon isotopic excursions (NCIEs) before and across the T-JB; the Rhaetian NCIE1 and NCIE2 occurred for 5‰ from *ca*. -24.0‰ to -29.0‰, whereas the NCIE3 across the T-JB occurred for 3.5‰ from *ca*. -23.5‰ to -27.0‰. The newly observed NCIEs in the deep mid-Panthalassa can be correlated with the $\delta^{13}C_{org}$ records in the shallow-marine Tethyan regions; i.e., St Audrie’s (England), Tiefengraben (Austria) and Čanj (Montenegro). This suggests that three NCIEs in the mid-Panthalassa reflect the global perturbations rather than local phenomena. Especially, the NCIE2 and NCIE3 occurred under high atmospheric CO_2 levels, whereas atmospheric CO_2 concentrations during the NCIE1 was around background values. This pCO_2 level during the NCIE1 might be attributed to consumption of atmospheric CO_2 by intensified weathering of the CAMP basaltic rocks. We thus consider that the NCIEs in the mid-Panthalassa before and across the T-JB were attributed to the volcanically CO_2 outgassing from multiple emplacements of the CAMP volcanism. In addition, the high atmospheric CO_2 level associated with the CAMP volcanism across the T-JB could promote the continental weathering in the shallow-marine regions, which might have accelerated burial of organic matter. This process likely resulted in deep-sea oxygenation in the mid-Panthalassa across the T-JB. From the above, the multiple emplacements of the CAMP volcanism during the Triassic-Jurassic transition had played a significant role for perturbations in carbon cycle in addition to the redox condition in the mid-Panthalassa.

キーワード：大量絶滅、中央大西洋火成岩岩石区、深海酸素イベント、有機炭素同位体比、深海チャート、日本
Keywords: mass extinction, Central Atlantic Magmatic Provinces (CAMP), deep-sea oxygenation, organic carbon isotopes, bedded cherts, Japan