Oceanic anoxic event at the Carnian/Norian boundary interval in the Black Bear Ridge section, British Columbia, Canada

TETSUJI ONOUE[1*], JOHN-PAUL ZONNEVELD[2], MICHAEL J. ORCHARD3, KATSUYUKI YAMASHITA4, HONAMI SATO5 AND SOICHIRO KUSAKA6

[1]Kumamoto University, Kumamoto 860-8555, Japan (*correspondence: onoue@sci.kumamoto-u.ac.jp)
[2]University of Alberta, Alberta T6G 2E3, Canada
[3]Geological Survey of Canada, Vancouver V6B 5J3, Canada
[4]Okayama University, Okayama 700-8530, Japan
[5]Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokosuka 237-0061, Japan
[6]Museum of Natural and Environmental History, Shizuoka, Shizuoka 422-8017, Japan

The transition between the Carnian and Norian (Upper Triassic) is characterized by a faunal turnover in major pelagic groups, such as radiolarians, conodonts, and ammonoids. The Black Bear Ridge section in northeastern British Columbia, Canada, consists of a continuously exposed sequence of upper Carnian through lower Norian continental margin strata. In order to assess late Carnian to early Norian environmental changes recorded in the section, we examined stratigraphic variations in $^{87}Sr/^{86}Sr$, $\delta^{13}C$, and $\delta^{18}O$ values, and also values of redox sensitive elements (V, Ni and Cr), in the Carnian/Norian boundary (CNB) interval.

The strata across the CNB display a positive shift in $\delta^{13}C$ values and a corresponding increase in the redox indices V/(V + Ni) and V/Cr. The synchronous increase in $\delta^{13}C$ values and redox indices suggests that burial rates of marine organic carbon increased in response to the development of anoxic conditions in the water column. An increase in $\delta^{13}C$ values in carbonate rocks across the CNB has also been reported from Upper Triassic sections in Europe (e.g., in the Pizzo Mondello section, Sicily), which suggests that the development of anoxic conditions within the CNB interval was widespread, affecting both the Panthalassan Ocean and Tethyan Sea. The geochemical data from this study, as well as from research into conodont biostratigraphy in the Black Bear Ridge section, show that the onset of oceanic anoxic conditions may have been responsible for the faunal turnover event at the CNB. The cause of this anoxic event is unknown, but the $^{87}Sr/^{86}Sr$ and $\delta^{13}C$ isotope data largely exclude the possibility that the event was triggered by dissociation of methane hydrates and degassing related to large-scale volcanic activity.