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Ultra-high resolution carbon isotope stratigraphy and correlation: Prospects for advanced researches on Cretaceous OAE2

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Cretaceous oceanic anoxic events (OAEs) are well known oceanic events typically represented by organic-rich dark sediments. During OAEs, large quantity of organic carbon had been deposited and had not recycled because of expanded anoxic bottom water mass. We can evaluate an OAE as a short-term departure from the steady state of carbon cycling that fluctuates with wave length of several million years. The OAE recorded across the Cretaceous Cenomanian/Turonian (C/T) boundary is called as OAE2 and is known as widely expanded oceanic anoxia that affected nearly global. Its intensity is believed to be strongest among the Cretaceous OAEs in terms of the oxygen deficiency and its extent. A positive 2-3 permil carbon isotope excursion derived from the perturbation of carbon cycling well characterizes OAE2 and is often employed as an interregional chemostratigraphic marker.

Detailed organic carbon isotope stratigraphy with resolution <1 kyr across the C/T boundary along the Kanajiri River in the Tappu area, Hokkaido, Japan was established based on samples collected with stratigraphic intervals of 10 cm. The carbon isotope value profile shows double peaked positive 2.5-3 permil positive excursion with a dividing trough and a plateau-like stable range above the second peak. These features are well comparable to the C-isotope stratigraphy of European sections (e.g. Paul et al., 1999), that subdivided the isotope profile into five segments namely Pre excursion, First build-up, Trough, Second build-up and Plateau intervals. Our C-isotope profile also shows two unique characters that have never been discussed with the European sections: step-like stable interval in the middle of First build-up and outstanding negative excursion as large as -2.7 permil in the middle of Second build-up (NEMO: Negative Excursion of Mid-OAE2). The isotope curve without finer scale fluctuations changes its mode into that with considerable millennial or submillenial variation across NEMO event. It could suggest important turnover of carbon circulation across NEMO event.

That result enables us correlating OAE2-corresponding interval of Pacific Tappu section with that of well studied European sections as detail as orbital cyclicity. LIPs formation as causal events of OAE2 were discussed from a European section based on Pb isotope fluctuation with stratigraphic control of detailed carbon isotope stratigraphy (Kuroda et al., 2007). Voigt et al. (2006), on the other hand, considered extensive cooling derived from perturbation of carbon circulation during OAE2. Pacific Tappu section with excellent tool for international correlation and with stratigraphic resolution much higher than those European sections should act a principal role for studying events associated with OAE2 as it can replicate these events to approve (or reject) their causal relationship between OAE2.

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