A hypothesis of paleoceanography in off-East Asian Pacific across the Cretaceous OAE2 time

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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 boundary (OAE2) is the widely spread oceanic anoxia that affected nearly global. Its intensity is believed to be strongest among the Cretaceous OAEs in terms of the oxygen deficiency and the extent of affected areas. 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 higher than 10 kyr interval 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 2-5 m. It enables us a study with horizon-to-horizon correlations. 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 able the second peak. These features are well comparable to the C-isotope fluctuation from European sections across the OAE2 horizon (Jarvis et al., 2006) as well as that from the Oyubari area in Hokkaido.

Benthic biological activity suggested from sedimentary structure, and stratigraphic distribution of planktonic foraminifera encompassing the OAE2 horizon in the Tappu section were compared with that in the Oyubari, Eastbourne (UK), Pueblo (USA) sections. Repeated deactivation and reactivation events of benthic organisms were observed. The deactivation is nearly synchronous with the onset of planktonic foraminiferal sequestration (temporary disappearance) and the reactivation corresponds to planktonic foraminiferal revival. These characteristic conjoined biological events are also recognized in the Oyubari section (Hasegawa, 1997, 1999) demonstrating considerable (namely not very local) extent of their causal oceanic events over off-East Asian Pacific. Onset of the initial benthic deactivation, a probable dysaerobia, precedes major dysaerobia recorded in the Pueblo and Eastbourne sections.

We discuss a hypothesis that can best explain the fact mentioned above sequence in Hokkaido, and that is concordant with global climatic changes suggested by previous studies across the OAE2. The hypothesis insists that the magnitude of land water run-off controlled the paleoceanography. The development of dysaerobic water and phenomena of biotic turnover in off-East Asian Pacific should have been controlled by a unique mechanism that is far different from that in Europe or in the Western Interior.

References

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