Contemporaneous massive subaerial volcanism and Late Cretaceous oceanic anoxic event 2 (OAE-2)

Junichiro Kuroda[1]; Nanako, O. Ogawa[2]; Millard F. Coffin[3]; Hidekazu Tokuyama[4]; Hiroshi Kitazato[1]; Naohiko Ohkouchi[5]

[1] IFREE, JAMSTEC; [2] IFREE; [3] ORi, Univ.Tokyo; [4] ORI, Univ. Tokyo; [5] JAMSTEC

http://ofgs.ori.u-tokyo.ac.jp/~ofgs/

Cretaceous time is punctuated by multiple depositional episodes of organic-rich black shales throughout the global ocean (i.e. Tethys, Atlantic, and equatorial Pacific) that have become known as Oceanic Anoxic Events (OAEs). An anoxic event occurred immediately before the Cenomanian-Turonian boundary (93.6 Ma), termed OAE-2, has been considered to be typical of OAEs because of its worldwide occurrence. It has been proposed that OAEs are ultimately caused by rapid and voluminous release of methane from gas hydrate in marine sediment, or by massive volcanic events associated with the formation of large igneous provinces (LIPs). However, general consensus on a causal mechanism has not yet been achieved.

Herein, we identified a 3 per mil negative shift in the isotopic composition of sedimentary organic carbon within approximately 15,000 years of the onset of a black shale layer, deposited during the OAE-2. At the same stratigraphic level, lead isotopic compositions in the aluminosilicate sediment fraction exhibit significant shifts toward characteristic values of contemporaneous igneous provinces (Caribbean and Madagascar LIPs). The two lines of evidence suggest abrupt increases in CO2 degassing and supply rate of aluminosilicate from the LIP(s), that resulted in rapid shifts of C- and Pb-isotopic compositions, respectively. We conclude that massive subaerial volcanism coincided with the onset of oceanic anoxic event-2, releasing a huge amount of CO2, other gases, and particulate matter into the atmosphere. The subaerial volcanism triggered significant climatic and environmental changes, inducing biotic crises and oceanic anoxia.

An oceanic anoxic event at the Early Aptian 'OAE-1a' is another representative expression of OAEs. It is noteworthy that the timing of OAE-1a synchronizes that of Ontong Java Plateau (OJP) formation, suggesting a possible linkage between OAE-1a and OJP eruption. However, we expect that response of the ocean-atmosphere system was not similar with that of OAE-2, because the eruption environment of OJP has been considered to be overwhelmingly submarine. In the presentation we will discuss the relationship between OAE and LIP eruptions mainly based on the case of OAE-2 and OAE-1a.