

## Paleoceanographic study of black shale at the Cenomanian/Turonian boundary by high-resolution geochemical mapping

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The Bonarelli horizon is typical black shale at the Cenomanian/Turonian boundary. Detail reconstruction of paleoenvironmental changes during the deposition of the Bonarelli horizon has been investigated using nondestructive, high-resolution geochemical analyses. The Bonarelli horizon is characterized by unbioturbated rhythmic alternation of dark and light layers. Based on lithological features, the Bonarelli horizon is divided into three lithostratigraphic units named Unit A, Unit B and Unit C in ascending order. Sediments constituting the Bonarelli horizon such as radiolaria, ichthyolith, coccolith, pyrite, barite and clay mineral have been quantitatively identified based on chemical compositions obtained from element compositional maps using an electron probe micro analyzer (EPMA). Vertical profiles showing fluctuation patterns of these sediments were obtained from compositional maps. TOC were also determined in about the same resolution in order to investigate the fluctuation pattern of organic matter.

The most remarkable result is that fluctuation patterns of radiolaria and organic carbon are not synchronized. Based on the vertical profiles of radiolaria and organic matter, two different microfacies were recognized in the Bonarelli horizon. One is organic-rich and radiolarian-poor facies named organic facies, the other is radiolarian-rich and organic-poor facies named radiolarian facies, respectively. Light nitrogen isotope composition of black shale implicate that the source of organic matter is mainly originated from nitrogen fixers such as cyanobacteria (Ohkouchi et al., 1997). We interpreted organic facies as cyanobacteria-rich environment, which indicates oligotrophic environments resulting from oceanic stagnation. In contrast, radiolarian facies is interpreted as high primary productivity as result from active upwelling.

Unit A is dominated by radiolarian facies. Organic facies also occurs intermittently. This shows that active upwelling condition resulted in high productivity dominated during the deposition of Unit A. Oceanic stagnation occurred intermittently in this period. Unit B and lower to middle part of Unit C are dominated by organic facies. This suggests that oceanic stagnation resulted in cyanobacteria-rich environment continued during the deposition of Unit B through middle part of Unit C. The upper part of Unit C is dominated by radiolarian facies. This implicates that active upwelling dominated again during the deposition of upper part of Unit C.