

High resolution analysis for the OAE 1b in the Vocontian Basin, SE France

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The Cretaceous was a time of greenhouse climates characterized by at least 15 degree warmer sea surface temperatures than the present one. During the climax of Cretaceous warming, anoxic condition in the oceans globally expanded, resulted in accumulations of organic rich sediments. These events are called Oceanic Anoxic Events (OAEs), and occurred at least 8 times during the Cretaceous period. The study of OAEs is important from three different perspectives: (i) the OAEs acted as the thermostat during the greenhouse climate because they eliminated carbon from atmosphere (CO₂) to sediments (black shales); (ii) the expansions of anoxic condition in the oceans caused mass extinctions of marine biota; (iii) most of source rocks were formed during Cretaceous time under anoxic oceanic environments. Recently, oxygen and carbon isotope data on planktic and benthic foraminifers reveal the development of two types of water-column structure during OAEs. The first type corresponds to intensified vertical water column stratification triggered by an increase in the surface water temperature or a decrease in salinity (e.g., Paquier level of OAE1b). The second type, represented by collapse of the vertical structure of the water column caused by abrupt deep water warming, is recognized in OAE 1a, OAE1d and OAE 2. Such OAEs are characterized by the increased primary production, drawing of carbonate platform and world-wide deposition of black shales. To understand the detailed depositional process and response of marine biota during OAE, we focused on the OAE1b sequence distributed in the eastern part of the Vocontian Basin which contains abundant well-preserved macro- and microfossils.

The Dauphinois Basin developed as part of a rifted European continental margin facing the northern Alpine Tethys Ocean during the Jurassic-mid-Cretaceous. It was situated at a paleolatitude of 25-30 degree N during the Aptian-Albian. The Vocontian basin corresponds to the hemi-pelagic part of the Dauphinois Basin with an estimated paleodepth of 500 to 1500 m. The OAE 1b interval of the Vocontian Basin comprises intercalations of four major black shale beds. These are: the Jacob level of the late Aptian age, and the Kilian, Paquier and Leenhardt levels of the early Albian age, in ascending order. In this study, high-resolution sedimentological, micropaleontological records are presented for the Albian Paquier level. The Paquier level is basically classified into three lithological layers of strongly laminated, faintly laminated, and massive based on the degree of development and preservation of laminations. Total abundance of planktonic foraminifers is extremely high during deposition of the laminated layers, and suddenly drops within massive layers. On the other hand, total abundance and diversity of benthic foraminifers are high during the accumulation of massive layers, and suddenly drops within laminated layers. Nannofossil abundance decreases throughout the Paquier interval, whereas nannoconids are bloomed within the laminated layers. Radiolarians, plant fragments and quartz grains are abundant within the laminated layers. These lines of evidence suggest that runoff from the epicontinental areas caused high productivity in the surface ocean and bottom water anoxia during accumulation of Paquier level.