

Litho-, bio-, chemostratigraphy across the Thomel Level (OAE 2) 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 (CO_2) 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. The Cenomanian/Turonian Boundary Event (Oceanic Anoxic Event 2; OAE 2) was the largest oceanic anoxic event during the Cretaceous Period, and it is characterized in the stratigraphic record by double positive peaks in the $\delta^{13}\text{C}$ curves of carbonate and organic carbon (Paul et al., 1999). The positive $\delta^{13}\text{C}$ shift is believed to have resulted from massive burial of isotopically light organic carbon generated globally in anoxic oceanic environments. However, in many areas, black shales and most organic carbon-rich layers around the OAE 2 horizon are intercalated in the different horizon as the $\delta^{13}\text{C}$ positive excursion because they are also overprinted by local oceanographic conditions.

The Thomel Level of the Cenomanian/Turonian (C/T) boundary in the Vocontian Basin (southeastern France) accumulated during the OAE 2, and it is marked by frequent intercalations of black shale and organic-rich marl. Detailed litho-, bio- and chemostratigraphy analyses across the C/T boundary in the Vocontian Basin indicate that the $\delta^{13}\text{C}_{\text{carbonate}}$ profile fluctuation across the Thomel Level corresponds well with changes in lithofacies, total organic carbon (TOC), and calcium carbonate (CaCO_3) abundance. Positive $\delta^{13}\text{C}$ excursions within the OAE 2 correlate with basal and middle parts of the Thomel Level that are characterized by high TOC, low CaCO_3 , and predominantly contain organic-rich sediments such as black shale and dark gray marl. On the other hand, negative $\delta^{13}\text{C}$ intervals within the OAE 2 correspond with lower and upper parts of the Thomel Level that consist of marly limestone and limy marl with low TOC and high CaCO_3 values. Since the fluctuation of redox conditions during the Thomel Level's deposition in the Vocontian Basin coincides well with the global carbon burial rate indicated by its $\delta^{13}\text{C}$ profile, the Thomel Level could be an ideal candidate for the reference section of the OAE 2.

Reference

Paul, C. R. C., Lamolda, M. A., Mitchell, S. F., Vaziri, M. R., Gorostidi, A., Marshall, J. D., 1999. The Cenomanian-Turonian boundary at Eastbourne (Sussex, UK): a proposed European reference section. *Palaeogeography, Palaeoclimatology, Palaeoecology* 150, 83-121.