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Paleoceanography of lower Upper Aptian black shale events in the Western Tethys

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A high-resolution study focussing on the distribution of calcareous nannofossils and stable isotopes was carried out to improve our understanding of mid-Cretaceous black shale formation. The studied part of the lower Upper Aptian is characterized by two major black shale couplets the Niveau Noire 4 (NN4) and Niveau Noire Calcaire 2 (NNC2) at the Serre Chaitieu section in the Vocontian Basin (SE Franc; Breheret, 1997). The NN4 and NNC2 occurs within the lower part of the *Globigerinelloides ferreolensis* planktic foraminifera Zone and NC7B calcareous nannofossil Zone. The studied interval represents a major long-term negative carbon isotope excursion following the Early Aptian Oceanic Anoxic Event 1a (OAE1a). The black shale couplet NNC2 is of supraregiopnal significance because of the occurrence of time equivalent black shales in the Western Tethys and Atlantic Ocean based on bio- and chemostratigraphic correlations (Herrle et al. 2004). Equivalents of the NNC2 may be a black shale horizon in the middle part of the *G. ferreolensis* Zone of the Roter Sattel section of western Switzerland and at the Mazagan Plateau (Deep Sea Drilling Site 545).

Calcareous nannofossil analyses indicates that the lower part of the studied succession is characterized by more mesotrophic surface water conditions including the black shale coupled of the NN4. In contrast, the middle to upper part of the studied succession is marked by oligotropic surface water and increasing surface water fertility with the onset of the NNC2 black shales. However, surface water fertility is low during the formation of the NNC2 black shales. The results of the study indicates that black shale formation of the NN4 and NNC2 was caused by different processes such as increasing surface water fertility and enhanced preservation of organic matter at the sea

floor. Therefore, the study underlines that different factors controlling the formation of regional and suraregional black shales. The most important factors are sea-level fluctuations, increasing productivity, and changes in precipitation and evaporation rates.