



## **OA3 and Upper Cretaceous Oceanic Red Beds (CORB)**

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After the Late Cenomanian Oceanic Anoxic Event 2 (OAE2) a time of widespread oxic sedimentation of oceanic red beds (CORBs, e.g. Hu et al., 2005) started during the Turonian. However, black shale deposition during the Coniacian-Santonian continued at least regionally. These black shales have been defined as oceanic anoxic event OAE3. CORBs are distributed worldwide during the Coniacian-Santonian. Especially the Tethyan paleogeographic domain and connected low latitude oceanic domains are characterized by such highly oxidised deposits, both below and above CCD.

In contrast, the distribution of Coniacian-Santonian black shales seems to be largely restricted to parts of the Atlantic and adjacent areas; e.g., Coniacian-Santonian black shales off Ivory Coast and Ghana are characterized by the presence of Milankovitch cycles defined by TOC variations, caused by cyclic upwelling along the Ivory Coast, probably driven by short-term climate changes. Black shales of the same age are present in the Cape Basin, the Angola Basin, along the Walvis Ridge, on the Demara Rise off Surinam, in the Venezuela Basin-Caribbean Sea and the Maracaibo Basin in Venezuela, and at the continental rise northward of the Blake Plateau. There, intercalations of black shales are reported within the red and brown clays of the Plantagenet Formation, defining a shifting critical boundary between regional anoxia and normal oxic deep-marine environments.

These black shales thus indicate that oxic conditions prevailed not in all parts of the world oceans after OAE2. At least the equatorial North Atlantic and the South Atlantic including parts of the Caribbean Sea were characterized by black shale deposition during this time interval. Local or regional oceanographic (upwelling) and tectonic (closed deep basins) factors may have contributed to the development of this anoxia during CORB times.

Thus, OAE 3 is not a global oceanic event but a more regional anoxic event that is essentially restricted to the to low-latitudinal part of the Atlantic and some adjacent epicontinental basins such as Maracaibo Basin and the Western Interior Basin, and it is absent in the Pacific and the Tethys. OAE3 is not a clearly defined, short-time event, but distributed over a longer time span, at least from the middle Coniacian to the early Santonian, a time span of about 3 Ma. Most of the sections in the equatorial Atlantic display continuous TOC-rich successions from Cenomanian-Turonian OAE 2 to Coniacian-Santonian-Lower Campanian black shales. The  $\delta^{13}\text{C}$  curve indicates a broad excursion of about 0.5% as a result of massive organic carbon burial in the Atlantic. In the southern North Atlantic and the South Atlantic transitional areas are characterized by black shale turbidites into red deep-water claystones.

Hu, X., Jansa, L., Wang, C., Sarti, M., Bak, K., Wagneich, M., Michalik, J. & Soták, J., 2005. Upper Cretaceous oceanic red beds (CORBs) in the Tethys: occurrences, lithofacies, age, and environments. *Cretaceous Res.* 26, 3-20.