Cretaceous Oceanic Red Beds (CORB) and Oceanic Anoxic Events in the Eastern Alps

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A major change in oceanic sedimentation from mid-Cretaceous sediments enriched in organic carbon to oceanic red beds (CORB – Cretaceous Oceanic Red Beds), mainly red shales and marls, occurred in the world oceans during the Late Cretaceous. The red coloration of CORBs indicates deposition in a strongly oxic bottom depositional environment. The main significance of this change is that it demonstrates that the deep ocean basins stopped to be the preferential burial site for organic carbon, accompanied by a major change in the oxygen level in the atmosphere and oceans (Hu et al., 2005).
CORBs occur in a broad geographic belt extending from the Caribbean across central north Atlantic, southern Europe, Eastern Europe to Asia. CORBs were deposited in variety of environments from continental slope to deep oceanic basin above and below CCD. Both the first and the last occurrence are often diachronic; a maximum of CORB distribution is noted during Coniacian to Early Campanian. However, black shale deposition during this time interval continued regionally. This OAE 3 is essentially restricted to the to low-latitudinal part of the Atlantic, the South Atlantic, the Caribbean Sea, and some adjacent epicontinental basins such as the Maracaoibo 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. 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.
CORBs in the Eastern Alps are present within a palaeogeographic north-south transect from the southern margin of the European Plate (Helvetic/Ultrahelvetic domain) to the Penninic Ocean (Rhenodanubic Flysch Zone) and the Austroalpine microplate to the south, including the Northern Calcareous Alps.
In the Helvetic (shelf) and Ultrahelvetic (slope) part of the European margin, the proportion of CORBs within the Upper Cretaceous successions increases significantly with increasing water depth and increasing pelagic character of the marls and limestones. Within the outer shelf pelagic grey limestones of the Helvetic shelf of Vorarlberg red intervals are present in the Turonian and Santonian. Further downslope, in the Ultrahelvetic realm, red intervals increase in number and thickness. In the Ultrahelvetic units of Upper Austria (Rehkogelgraben, Buchberg) CORB define a continous red interval from the early

Turonian to the lowermost Campanian. The onset of CORB deposition in the Ultrahelvetic Zone seems to correspond to a major change in paloceanographic conditions from anoxic during the Late Cenomanian OAE 2 to highly oxic during the early to middle Turonian. The end of CORB deposition in the Ultrahelvetic realm is controlled mainly by increasing clastic input and a shallowing of the basin.
In the Rhenodanubian Flysch Zone 3 intervals of CORBs are present. The lowermost interval of red shales (Untere Bunte Schiefer) has been dated as latest Albian to early Cenomanian (Oberaschau section). Higher up in the section, CORB occur in the Coniacian-Early Campanian (Seisenburg Formation) and in the Late Campanian (Perneck Formation). CORBs in the Rhenodanubian Flysch Zone are mainly controlled tectonically by low clastic input and low turbidite frequencies.
In the Austroalpine Northern Calcareous Alps CORBs occur from the middle Santonian onwards within the upper parts of transgressive sequences of the Gosau Group. In areas where clastic input was low, CORB deposition continued up into the Maastrichtian (Wagreich & Krenmayr, 2005). A peak of oceanic red beds is inferred for the middle Santonian - Early Campanian in the Austroalpine. Sediment colour in the Nierental Formation is mainly controlled by bottom water oxygenation, oceanic currents and the morphology of the sea floor within the complex slope basin setting. Thick CORB intervals are present only where siliciclastic sediment input is missing or relatively low.

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

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