Geophysical Research Abstracts, Vol. 7, 10805, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10805

Development of highly oxic pelagic sedimentation in the lower Turonian – a high-resolution analysis (Buchberg, Austrian Alps)

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Red coloured marine sediments form when Fe is oxidised and bound in iron oxides. This chemical reaction is only possible under absence of organic carbon, as organic matter degradation leads to reducing conditions precluding the formation of iron oxides. The major factors controlling the oxidation of organic carbon are (1) the amount of available oxygen (oxygen content of the oceans bottom waters and of the sediment pore waters), (2) the amount of organic carbon that has to be oxidised (C_{org}-flux) and (3) the oxygen exposure time (dependent on the sediment accumulation rate). Thus, the syn-sedimentary and early diagenetic redox conditions are the result of the interplay of these three factors.

Unlike the event-like nature of black shale deposition during the Early Cretaceous the formation of marine red sediments in the Late Cretaceous appears to be rather diachronous although widely distributed. First appearances are known already from the Aptian, well before the global Cenomanian / Turonian black shale event. This means that marine red beds formed locally already before the period of black shale events had ended. Widespread deposition of marine red beds, however, sets in during the Turonian, with apparent peak abundances in the Santonian to lower Campanian and upper Campanian to Maastrichtian.

In the Buchberg section in the Ultrahelvetic Units of Upper Austria, the change from grey to red pelagic sedimentation is nicely exposed and can be studied at high resolution. The 7 m long profile comprises a succession of planktonic foraminifera-rich marls and limestones which indicate sedimentation above the local CCD. The restriction of the red colour to discrete beds reflects its syn-depositional to early diagenetic

character. The section can be assigned to nannofossil standard zones CC10 to CC12 (UC3 – UC8a). The immediate transition from grey to red layers lies in the lower Turonian, zone CC11/UC7, above the FO of *Quadrum gartneri*. The top of the section can be dated as middle Turonian, zone CC12/UC8a, according to the FO of *Eiffellithus eximius*. *Helvetotruncana helvetica* is present in the red to grey transitional interval and gives evidence for an early to middle Turonian age of the marine red beds. Strontium isotope stratigraphy also confirms a Turonian age of the succession. Thus, the time period of the mayor change in the oceans oxidation state is recorded in the Buchberg section. We present a high resolution (bed-by-bed) study using foraminifera and geochemical proxies. It is interesting to note that the oxic conditions which lead to the red sediment colour must have established in several steps. The Buchberg section exposes alternations between red and grey marls as well as between red and grey limestones, indicating that sedimentation rate and productivity are most probably not the only factors controlling the colour distribution and that the oxygen content of the bottom waters must have changed several times during this period of transition. We study this global process of climate and oceanic change by investigating the microfaunal changes and relating these to geochemical parameters, and develop a model for both the marl-limestones facies shifts, and the successive development of super-oxic conditions within the individual facies types.