Geophysical Research Abstracts
Vol. 13, EGU2011-6185, 2011
EGU General Assembly 2011

Long- and short-term paleoceanographic changes in the Western Tethys and the North Atlantic during the mid-Cretaceous greenhouse time

Martino Giorgioni (1), Helmut Weissert (1), Stefano M. Bernasconi (1), Peter A. Hochuli (1,2), Rodolfo Coccioni (3), Therese I. Garcia (1), Christina E. Keller (1), and Maria Rose Petrizzo (4)

(1) Geological Institute, ETH Zurich, Zurich, Switzerland (martino.giorgioni@erdw.ethz.ch), (2) Palaeontological Institute, University of Zurich, Zurich, Switzerland, (3) Dipartimento di Scienze dell'Uomo, dell'Ambiente e della Natura, Università di Urbino, Urbino, Italy, (4) Dipartimento di Scienze della Terra, Università degli Studi di Milano, Milano, Italy

In this study we test if plate-tectonically driven changes in oceanic circulation had an impact on Tethys oceanography, as predicted by models (e.g. Poulsen et al., 2001). We trace sedimentological changes during the Albian-Cenomanian across the Western Tethys and into the North Atlantic. We integrate litho-, bio-, and isotope stratigraphy to correlate in high-resolution sections from pelagic to coastal settings.
Albian deep-water successions are very heterogeneous: in the Southern Tethys and the North Atlantic they are characterized by black shales alternating with bioturbated marlstones and marly limestones, arranged in cycles matching with orbital periodicities (e.g. Herbert & Fischer, 1986), and sometimes punctuated by reddish layers (Scott et al, 2009). Coeval sediments deposited on the northern Tethyan shelf are characterized by condensed mixed carbonate-siliciclastic facies, punctuated by phosphorite hardgrounds containing microbialites (Föllmi, 1989).
A change in pelagic sedimentation along the Southern Tethyan margin occurred in the Late Albian. Varicolored Marne a Fucoidi are replaced by whitish or reddish micritic limestones. Along the northern Tethyan shelf, Albian condensed successions of the Garschella Formation are replaced by micritic pelagic limestones of Upper Albian or Lowermost Cenomanian age. These changes in shelf sedimentation record altered surface water conditions and a weakening of episodically strong shelf current intensity. Latest Albian changes in sedimentation observed across the Tethys Seaway mark the onset of Late Cretaceous chalk-sea conditions (Hay, 2008). Detailed stratigraphic correlation suggests that the change to white micritic carbonate ooze occurred first in the southern Tethys (ticinensis zone), then along the northern Tethys (upper appenninica zone), and finally in the North Atlantic (appenninica-globotruncanoides zone).
Carbon isotope data display cycles of 400kyr periodicity until the early Late Albian. These cycles stop being recorded in the ticinensis zone, when the first chalk starts occurring in the Tethys. The nature of the observed changes suggests that the unstable Aptian-Albian oceanography ("white-black-red mode") was replaced by a stable Cenomanian oceanography ("white mode"). The Late Albian opening of the Equatorial Atlantic Gateway is proposed as the most important trigger of the observed change in the Tethyan oceanography.

References:

Herbert T. & Fischer A. - Milankovitch climatic origin of mid-Cretaceous black shale rhythms in central Italy - Nature, vol. 321, June, 1986

Föllmi K. - Evolution of the mid-Cretaceous triad: platform carbonates, phosphatic sediments, and pelagic carbonates along the northern Tethys margin - Lecture Notes in Earth Sciences, vol. 23, 1989

Hay W. - Evolving ideas about the Cretaceous climate and ocean circulation - Cretaceous Research, vol. 29, pp. 725-753, 2008

Poulsen C. J., Barron E., Arthur M. A., Peterson W. H. - Response of the mid-Cretaceous global oceanic circulation to tectonic and CO2 forcings – Paleoceanography, vol 16, n. 6, pp. 576-592, December 2001

Scott R. W., Hu X., Wang C., Wagreich M., Jansa L. - Introduction to Cretaceous Oceanic Red Beds: stratigraphy, composition, origins, and paleoceanographic and paleoclimatic significance - in: "Cretaceous

Oceanic Red Beds: stratigraphy, composition, origins, and paleoceanographic and paleoclimatic significance", SEPM Special Publication n. 91, 2009