Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03705, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03705
EGU General Assembly 2008

Cretaceous carbon cycle and climate: Enigmatic beginning of the Aptian C-cycle perturbation

C. E. Keller (1), S. Méhay (1), S. M. Bernasconi (1), E. Erba (2), H. Weissert (1)

(1) Department of Earth Sciences, Geological Institute, ETH Zurich, Universitätsstrasse 16, 8092 Zürich, Switzerland, (2) Department of Earth Sciences, University of Milan, Via Mangiagalli 34, 20133 Milan, Italy (Christina.Keller@erdw.ethz.ch)

Cretaceous marine sediments hold some of the best records of major climate perturbations and of response mechanisms of the biosphere to these perturbations. From the Barremian to the Albian, the carbon isotope record is marked by several high amplitude positive carbon isotope excursions. The most important excursion happened during the early Aptian and is preceded by a prominent short-term negative spike, the origin of which is still uncertain. The positive C isotope anomaly is assumed to be the result of an increased burial of organic matter caused by a greenhouse climate that was initiated by the Ontong-Java volcanism. Yet, the beginning of this volcanism precedes the Aptian C isotope excursion (Tejada et al., 2002). This led to the hypothesis that the real beginning of the "Aptian greenhouse pulse" had its beginning a lot earlier, in the mid-Barremian event (MBE; Coccioni et al., 2004; Weissert et al., 2004) with a first 0.5% positive shift in the carbonate carbon isotopes.

In this study, a high-resolution C-isotope stratigraphy covering the Barremian-Early Aptian has been established for three different pelagic sections from the southern margin of the Tethys Ocean (southern Alps, northern Italy) in order to determine the cause of the early Aptian negative spike and test the MBE-hypothesis.

The base of the negative Carbon isotope spike in the "reference section" of **Cismon** occurs at a dissolution horizon (values below horizon $\sim$2.75 permil, above $\sim$2.5 permil, which could reflect a shallowing of the CCD coinciding with the negative isotope spike. The values then slowly decrease over $\sim$15 cm ($\sim$ 15 ka; Erba et al., 1999)

down to ∼2.0 permil before an abrupt drop to 1.36 permil within the uppermost 2 cm (∼ 2 ka) of the negative spike occurs. The organic carbon isotope stratigraphy is in progress. A possible increase in the isotopic fractionation during the first decrease of the carbonate C isotopes could reflect an increase of pCO_2 due to the Ontong-Java volcanism. The following rapid drop might be due to a methane pulse and thus a rapid addition of isotopically light C to the ocean-atmosphere reservoir.

The **Pusiano** section features a comparable drop in carbon isotope composition, but there it occurs over a range of several metres. Pusiano seems to be a very expanded section with a high sedimentation rate, which might be due to sedimentary drifts and/or redeposited material probably from a near structural high.

In the **Polaveno**-**San Giovanni** section, an upper Hauterivian-lower Barremian interval has been sampled. After ∼13 m of rather stable carbonate carbon isotope values around ∼1.6 permil, a shift of ∼+0.5 permil within 2 m occurs. Additionally, two prominent black shale intervals are present at the base of this shift, whereas in the lower part of the section only minor black shales are recorded. This could be an indication of climate change and perhaps might even reflect the MBE.

We will discuss the implication of the different rates of change in the different sections for the origin of the carbon isotope shifts.

References:

Coccioni, R.; Galeotti, S.; Marsili, A. & Sprovieri, M. (2004): The Mid-Barremian event (MBE): The prelude to the OAE 1a. Geophysical Research Abstracts 6, 05130.

Erba, E.; Channell, J.E.T.; Claps, M.; Jones, C.; Larson, R.; Opdyke,B.; Premoli Silva, I.; Riva, A.; Salvini, G. & Torricelli, S. (1999): Integrated stratigraphy of the Cismon Apticore (Southern Alps, Italy): A “reference section” for the Barremian-Aptian interval at low latitudes. Journal of foraminiferal research 29 (4), 371-391.

Tejada, M.L.G.; Mahoney, J.J.; Neal, C.R.; Duncan, R.A. & Petterson, M.G. (2002): Basement geochemistry and geochronology of central Malaita, Solomon islands, with implications for the origin and evolution of the Ontong Java Plateau. Journal of Petrology 43, 449-484.

Weissert, H. & Erba, E. (2004): Volcanism, CO_2 and palaeoclimate: a Late Jurassic-Early Cretaceous carbon and oxygen isotope record. Journal of the Geological Society 161, 695-702.