

***Interactive comment on “Coccolithophore  
response to climate and surface hydrography in  
Santa Barbara Basin, California, AD 1917–2004”  
by M. Grelaud et al.***

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The manuscript is presenting high resolution data of six coccolithophore species (relative abundance and carbonate coccolith weight) in the varved sediments of the Santa Barbara Basin (SBB) from approximately the last 80 years. A main goal is to reconstruct past seasonal and annual coccolithophore response to surface hydrographic changes, including the ENSO and PDO anomalies in this region. This is an interesting paper but there are several issues that need clear explanations and discussion.

AGE MODEL AND SEASONAL RESOLUTION

(section 2.1 pages 4132-33) A new result presented in this paper is the seasonality of

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coccolithophores inferred from the varves. In order to have this type of resolution it is important to precisely comment on the age model and sampling. The final age model with a mean resolution of about 3 months seems unrealistic (lines 15-17, page 4133). The core used in this study is a core B retrieved from a multicore collected in SBB. The core B was sampled every millimeter, not as a function of seasonal varve thickness that is known to be variable, but rather assuming a constant sedimentation rate (?). In addition, the dating uncertainty for core A dated in Hughet et al. (2007) (used to establish the age model of core B) is of about 2 years prior to 1980 A.D. and of about 1 year for younger sediment. The fine-tuning of the chronological *G. oceanica* relative abundance of the core B to the extended NINO3 index needs further explanation. This tuning is based on previous trap studies showing the relationship of *G. oceanica* flux with El Niño anomaly in SBB (De Bernardi et al., 2005). However, in the recent study on a SBB core (De Bernardi et al., 2008 Paleoceanography). It was confirmed that the increase in *G. oceanica* coccolith flux in SBB provides evidence for the poleward transport of El Niño's conditions to higher latitudes. This relationship was mainly shown by *G. oceanica* fluxes and not by the relative abundances. A strong interannual variability and linkage with PDO and El Niño intensity was also demonstrated.

The tuning of *F. profunda* with instrumental monthly summer sea surface temperatures in SBB, mainly based on the ecological study off Bermuda in the N. Atlantic (Haidar and Thierstein, 2001), also needs clarification. It has been shown from time series sediment traps in SBB that *F. profunda* coccolith fluxes increase during ENSO conditions, when the water column is strongly stratified. It is in fact puzzling why in this paper this species doesn't increase its abundance during the last 30 years of warming.

#### COCCOLITH ASSEMBLAGES, HUMAN VERSUS AUTOMATED RECOGNITION

There are only very few previous studies on coccolithophores in the SBB and I missed a comparison with a recently published paper that is dealing with the coccolithophore response to the half century of interannual climatic variability in SBB using not an automated recognition software (SYRACO) but human counts (De Bernardi et al., 2008,

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Paleoceanography). This study is using previous sediment trap data from the same basin to interpret the core record. From this study, it is clear that the main signal is registered in the species flux change and not in the relative abundances. The discrepancy of species percentages of the two counting methods (human versus SYRACO) needs to be considered (for example, the relative abundances of *E. huxleyi* and *G. ericsonii*). This latest small species (<2.5 micron) could not be so easily identifiable by the automated system since (the bridge crossing the coccolith central area needs to be identified using the rotating stage). Also, different *E. huxleyi* types with distinct morphological changes and coccolith carbonate quota are present and needs to be considered for the discussion.

#### COCCOLITH ECOLOGY AND CARBONATE QUOTA IN SBB DURING THE 20<sup>th</sup> CENTURY WARMING

In the presented record the last 30 years warming shown by instrumental records is not shown in the coccolith ecology. A discussion on this should be considered (including the planktonic foraminifera response (Field et al., 2006, Science)).

The increase in individual *E. huxleyi* and *G. oceanica* coccolith weight shown by the line regression (figure 5b page 4159) is intriguing. It is surprising the attempt to link these results with the warming, since no other ecological changes in the assemblages are observed. In addition, there is a very high variability in the coccolith weight that needs a discussion.

(lines 12-19) An increase in calcification rate (without an associated increase in organic carbon production) would increase the surface CO<sub>2</sub> concentration, acting as a positive feedback on CO<sub>2</sub>. Also note that the increase in coccolith calcite production would not necessarily be shown in more heavily calcified individual coccoliths (so no conclusions on calcite production and feedbacks can be claimed).

Since these results are based on an automated recognition it would be critical to check if the system didn't mislead different carbonate quota with a change in assemblages

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(for example *E. huxleyi* to small *Gephyrocapsa* spp.).

It is hard to conclude anything about *G. oceanica* ecology in this paper since the record has been tuned with the El Niño to obtain the high resolution age model.

There is no discussion on the coccolithophore response to the intensity of El Niño and PDO variability.

Other remarks:

When the name of a species is mentioned at the beginning of a sentence it is conventional to write the full genus name (for example *Emiliana huxleyi* and not *E. huxleyi*).

Line 1-2 page 4131: "... coccolithophores consist of <10 micron calcareous plates"  
This is not correct since there are species such as *C. pelagicus*, and *C. leptoporus*, that could have a larger size

line 14: "southern species" should be changed with tropical species

line 25, page 4138: Kincaid et al., 2000, doesn't present any coccolith data.

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