ECORD Grant 2011 - Final report

Studying phase relations of orbital forcing and terrestrial (ice) response in the Miocene

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For the study of oxygen isotopes from benthic foraminifera 385 samples were taken at the Bremen core repository. Magnetic susceptibility, color, $\delta^{18}O$ and $\delta^{13}C$ data (both of benthic foraminifera) were generated (see Fig.1). Some samples were unfortunately barren of benthic foraminifera; therefore no benthic isotope data could be obtained. For 368 samples isotope results could be obtained, the other ones were either barren of foraminifera or erroneous measurements could not be repeated due to lack of foraminifera present. Including some repeated measurements, 381 isotope measurements were made. Due to the scarcity of benthic foraminifera most measured samples contained less than 5 cleaned specimens; isotope data are therefore noisier than hoped for.

Results show that Miocene benthic isotope data are influenced by precession and obliquity, especially in the older part (~9.7-10 Ma, see Fig.1). Cross spectral analysis (Fig.2) shows that benthic oxygen isotope data lag the magnetic susceptibility signal by 19±10 degrees in the obliquity band, corresponding to ~2±1 kyr. This is in range with younger phase determinations by Tiedemann & Franz, 1997 for offsets of the obliquity phase between their tuning target and the oxygen isotope values, though care has to taken for such a comparison due to a tuning to a different orbital solution.

Data and preliminary interpretations were presented at the EGU 2012, a manuscript is in progress.

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References:

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Tiedemann, R. & Franz, S., 1997. Deep-water circulation, chemistry, and terrigenous sediment supply in the equatorial Atlantic during the Pliocene, 3.3-2.6 Ma and 5-4.5 Ma, in: Shackleton, N. Curry, W. Richter, C. Bralower, T. (Eds.), Proc. ODP, Sci. Results, Vol. 154. College Station, TX (Ocean Drilling Program), pp. 299-318.

Budget

	requested	real costs	comment
travel to Bremen and back	124.4	134.2	includes travel within Bremen, 2 persons
accomodation Bremen	80	177	2 persons
isotope measurements	776	762	
sum	980.4	1073.2	

Costs exceeding the ECORD grant were covered by the Stratigraphy/Paleontology group of the University Utrecht.

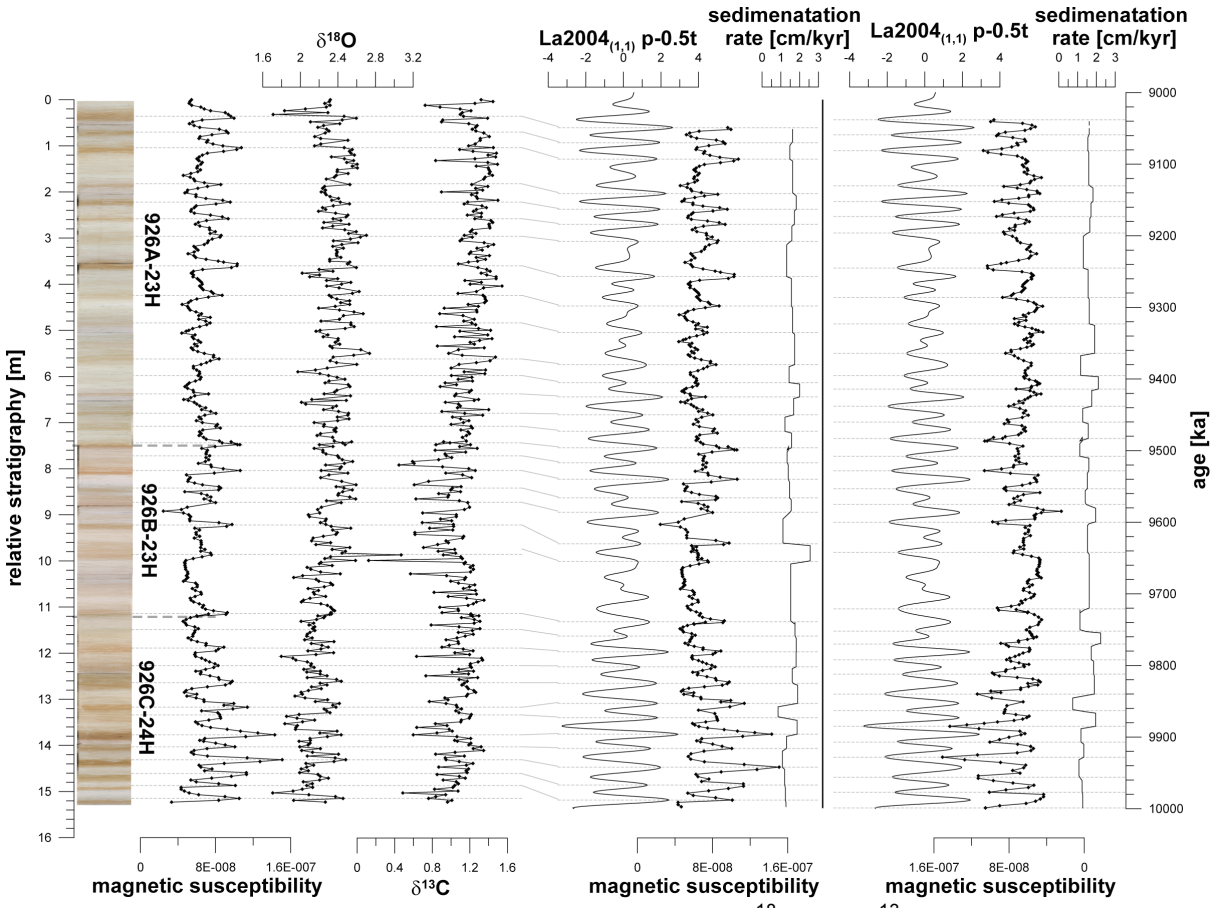

Figure 1: Core photograph (left), magnetic susceptibility, $\delta^{18}O$ and $\delta^{13}C$ data of samples from ODP Site 926. Two tuning options of this record to p-0.5t minima- and maxima are shown at the right, including resulting ages.

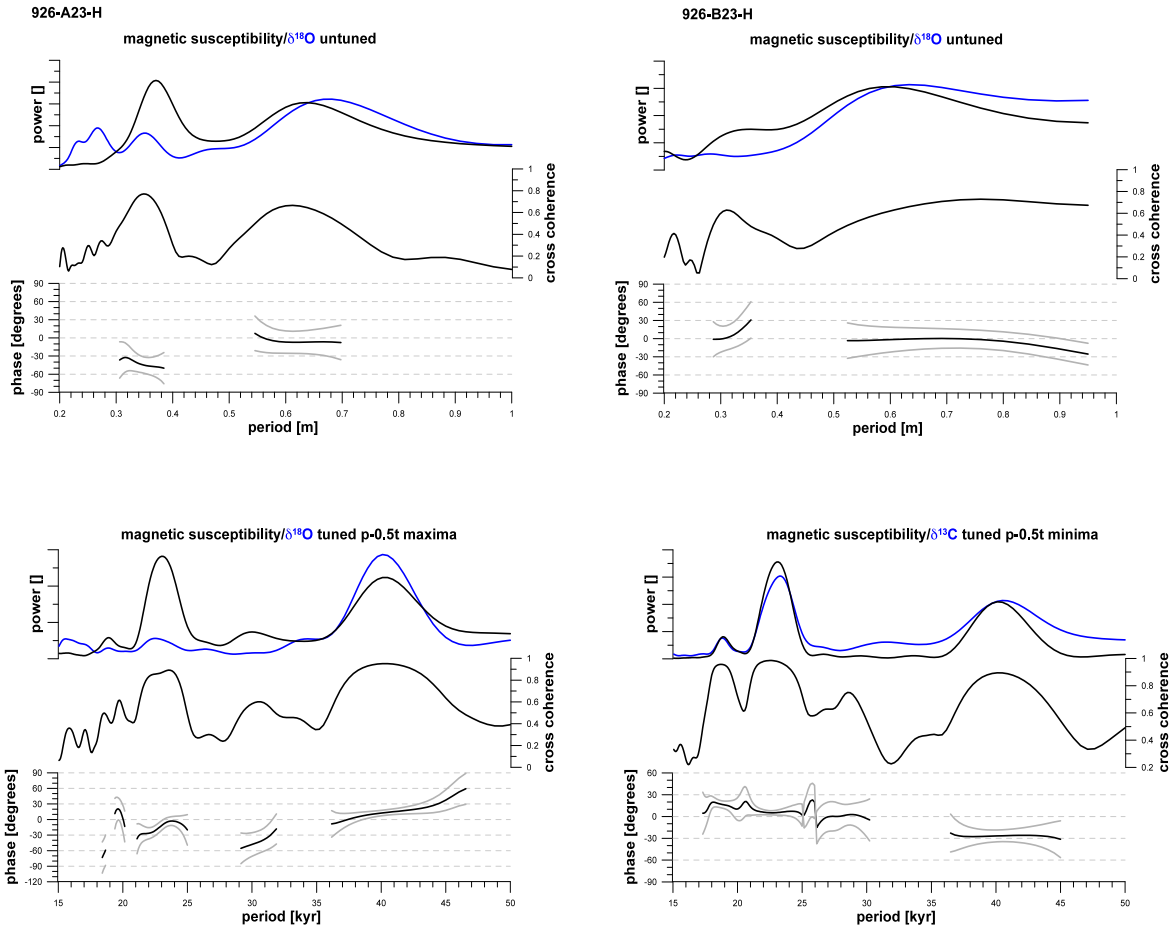

Figure 2: Phase relation of the magnetic susceptibility to oxygen (left) and carbon isotope data (right). Shown is the relative power, cross coherence and phase relative to the magnetic susceptibility/orbital solution (reference series in black, respectively). Positive phases indicate a lag; the phase was shifted by 180 degrees for carbon isotopes.