On the potential role of marine calcifiers in glacial-interglacial dynamics

A.W. OMTA[1,*], G.A.K. VAN VOORN[2], R. E. M. RICKABY[3], AND M. J. FOLLOWS[1]

[1]EAPS Department, MIT, 77 Mass. Ave., Canbridge, MA 02139, USA; omta@mit.edu, mick@ocean.mit.edu
[2]Biometris, Wageningen University & Research, P.O. Box 100, 6700 AC Wageningen, The Netherlands; george.vanvoorn@wur.nl
[3]Department of Earth Sciences, Oxford University, South Parks Road, OX1 3AN, Oxford, UK; rosr@earth.ox.ac.uk

Ice-core measurements have revealed a highly asymmetric cycle in Antarctic temperature and atmospheric CO2 concentration during the last 800 kyr. Both CO2 and temperature decrease over 100 kyr going into a glacial period, then steeply increase over less than 10 kyr at the end of a glacial. There does not yet exist wide agreement about the causes of this cycle or about the origin of its shape. Here, we explore the possibility that an ecologically driven oscillator plays a role in the dynamics of the cycle. A conceptual model describing the interaction between calcifying phytoplankton and ocean alkalinity shows interesting features: (i) it generates an oscillation in atmospheric carbon dioxide with the characteristic asymmetric shape observed in the ice-core record, (ii) the system is able to transform a sinusoidal Milankovitch forcing into a sawtooth-shaped output, and (iii) there are spikes of enhanced calcifier productivity at the glacial-interglacial transitions, consistent with several sedimentary records. This suggests that ecological processes might play an active role in the observed glacial-interglacial cycles. Thus, our study [1] potentially provides a fundamental shift in our understanding of how and why carbon is released from the oceans to the atmosphere during deglaciations.

[1] Omta *et al* (2013) *Glob. Biogeochem. Cyc.* **27**, 692-704