The importance of accurate and precise temperature reconstruction for alkenone paleobarometry

MARCUS P. S. BADGER[1*], RICH D. PANCOST[2]

[1]Department of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's road, Bristol, BS8 1RJ, U.K., marcus.badger@bristol.ac.uk (* presenting author)
[2]Organic Geochemistry Unit, Bristol Biogeochemistry Research Centre, University of Bristol, Cantock's close, Bristol, BS8 1TS, U.K., r.d.pancost@bristol.ac.uk

By measuring the carbon isotope ratio of long chain ketones produced by haptophyte algae (alkenones) the isotope fractionation during photosynthesis (ε_p) can be determined. Fractionation is dependent on the concentration of carbon dioxide in surface waters, thus, past atmospheric CO_2 can be reconstructed. Recent studies have successfully applied this technique at across several intervals of rapid climatic change in the Cenozoic [1-4], and efforts have been made to use alkenone paleobarometry to constrain climate (or Earth system) sensitivity [2].

Several factors are important to the accurate and precise determination of atmospheric CO_2; for example, recent work has focussed on the effect of changes in algal cell size [5, 6]. However, reconstructions are also highly dependent on the accurate and precise determination of sea surface temperature (SST), as this effects both the determination of ε_p from alkenone $\delta^{13}C$ values, and the conversion of $[CO_2]_{(aq)}$ to atmospheric pCO_2. This has become of paticular importance given the multitude of proxies now applied to the reconstruction of SST, and uncertainty about exactly what each proxy represents.

Here we assess the sensitvity of alkenone pCO_2 estimates to innaccurate and/or inprecise SST reconstructions using new high resolution data from the Pliocene, and investigate the possible implications for previously published records. We highlight the importance of these results, especially the revised uncertainties of paleo-pCO_2 estimates, to understanding climates of the past and estimating climate sensitivity (or Earth system sensitivity) for models of the future.

[1] Bijl et al., (2010) *Science* **330,** 819-821. [2] Pagani et al., (2010) *Nature Geosciences* **3**, 27-30. [3] Seki et al., (2010) *EPSL **292,** 201-211*. [4] Pagani et al., (2011) *Science* **334**, 1261-1264. [5] Henderiks and Pagani (2007) *Paleoceanography* **22**, PA3202. [6] Plancq et al., (2012) *Paleoceanography* **27,** PA1203.

The Major Element Composition of Earth's Core

JAMES BADRO[1*], JOHN BRODHOLT[2], ALEXANDER COTE[1,2]

[1]IPGP, Paris, France, badro@ipgp.fr (* presenting author)
[2]UCL, London, UK, j.brodholt@ucl.ac.uk

Earth's core formed as a results of a major chemical differentiation event; the melting of accretionary building blocks (meteorites, planetesimals, protoplanets) leads to a separation of the metal from the silicate, ensued by a gravitationally-driven segregation of a dense metal-rich core at the centre of the planet, with the lighter buoyant silicates remaining on top to form the mantle and crust. The bulk composition of the core depends on the path and conditions (pressure, temperature, redox) at which core formation took place; the process also leaves an imprint on the residual bulk silicate Earth, a record that is observable in present-day mantle rocks.

Constraining experimental and theoretical data with geophysical (core density and velocity profiles) observations provides a robust way to estimate the present day composition of the core, as well as the conditions under which it formed.

We will present results obtained from ab initio molecular dynamics calculations to estimate outer-core density and seismic velocity, and combine it with mineral physics on the inner core to define a range of possible compositions of the core that satisfies the observations. We will interpret these results and propose a consistent compositional model, and formulate plausible scenarios for core formation.