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On upper ocean density reconstructions using planktic foraminiferal calcite δ^{18}O

Didier Roche (1,2), Thibaut Caley (3), and Claire Waelbroeck (1)

(1) CNRS, Laboratoire des Sciences du Climat et de l'Environnement, Gif s/s Yvette, France (didier.roche@lsce.ipsl.fr), (2) Vrije Universiteit Amsterdam, Faculty of Science, Cluster Earth and Climate, de Boelelaan 1085, Amsterdam, the Netherlands, (3) EPOC, UMR 5805, CNRS, University Bordeaux, Pessac, France

The δ^{18}O of calcite tests from planktic foraminifer preserves a signal that is dual. The signal depends linearly on the δ^{18}O of the seawater in which the foraminifer lives in and through a quadratic relationship to the temperature of the seawater at time of calcification. The δ^{18}O of seawater near the surface is strongly dependent on the hydrological cycle and on local mixing of the water masses. It usually bears a relatively strong relationship to regional seawater salinity since the latter is affected by the same processes except the fractionation processes occurring in the atmosphere. In summary, the δ^{18}O of the calcite of planktic forminifer has a potentially strong relationship with the two variables determining the density of seawater, temperature and salinity.

Billup and Schrag (2000) used planktonic foraminifera δ^{18}O calcite from the mixed layer (*G. Sacculifer* and *G. ruber*) as a proxy of surface water density. This assume that foraminifera species have no different living habitats in the water column and throughout the year. They also limit their study to the tropical and subtropical surface ocean.

To progress on this issue of paleo-density reconstructions using foraminiferal calcite, we first use the recently developped FAME (Foraminifer As Modeled Entities) model to evaluate the relationship between the $\delta^{18}O_c$ of calcite for different species of foraminifer (*N. pachyderma*, *G. Bulloides*,*N. Incompta*, *G. Ruber*, *G. sacculifer*) and the seawater density for present-day conditions and the whole ocean. The use of the FAME model allows to sample the $\delta^{18}O_c$ and density of the ocean in the vertical and time in for each specie and thus reconstruct their common relationship to density in a more mechanistic way.

Last Glacial Maximum simulations with the isotope-enabled numerical climate models will be used to investigate the stability of the relationship between the $\delta^{18}O_c$ and the seawater density and discuss the applicability of the δ^{18}O calcite of foraminifera to the past quantification of surface ocean density.