Geophysical Research Abstracts
Vol. 20, EGU2018-5963, 2018
EGU General Assembly 2018

Global foraminifera d13C database to assess changes in the efficiency of the soft tissue pump on glacial-interglacial timescales

Sarah S. Eggleston (1,2), Olivier Cartapanis (3), Samuel L. Jaccard (3), Eric D. Galbraith (1,4)

(1) Institute for Environmental Science and Technology (ICTA), Universitat Autonoma de Barcelona, Bellaterra, Spain (sarah.eggleston@gmail.com), (2) Eidgenössische Materialprüfungs- und Forschungsanstalt, Laboratory for Air Pollution / Environmental Technology, Dübendorf, Switzerland, (3) Geological Institute and Oeschger Center for Climate Change Research, University of Bern, Bern, Switzerland, (4) Catalan Institution for Research and Advanced Studies (ICREA), Spain

The d13C of planktonic and benthic foraminifera over glacial-interglacial timescales represents a convolution of many processes, including the efficiency of the soft tissue pump, a major driver of past carbon cycle. Here we use a global database of more than 1000 individual records from benthic and planktonic species to derive regionally and vertically coherent signals over the last 150 kyr.

The data indicate relatively good agreement amongst planktonic and shallow-dwelling (above 1500m) benthic species at low latitudes; this signal also follows that of the atmosphere closely. The signal common to all benthic species at deep sites is in rough agreement with d13C of planktonic species at high latitudes. These general features are interpreted to reflect long term equilibrium between surface waters and the atmosphere, and relative isolation of the deep ocean, which intersects with surface living planktonic foraminifers only at high latitudes. At the same time, the marine soft tissue pump acts (to a greater extent in the low latitudes) to increase the vertical gradient of d13C.

We examine the evolution of the difference between d13C of low-latitude shallow and deep benthic species as a proxy for the efficiency of the soft tissue pump over the last glacial cycle. The vertical gradient of d13C is highest, indicative of increased soft tissue pump efficiency, during Marine Isotope Stages (MIS) 6, 4 and 2, with smaller local maxima during MIS 5d and 5b. The agreement of this signal with previous hypotheses regarding changes in the soft tissue pump on these timescales suggests that using a geographically and species-diverse d13C dataset from foraminifera may provide a reasonable proxy for this major driver of the carbon cycling on glacial-interglacial timescales.