NEGATIVE STABLE CARBON ISOTOPIC ANOMALIES IN THE UPPER WESTERN SOUTH ATLANTIC DURING HEINRICH STADIALS 3 AND 2

Marília Campos[1], Cristiano Chiessi[1], Ines Voigt[2], Alberto Piola[3,4], Henning Kuhnert[2], Stefan Mulitza[2]

Authors' affiliation – [1]University of São Paulo, Brazil. [2]MARUM, University of Bremen, Germany. [3]SHN, Argentina. [4]FCEN, Universidad de Buenos Aires; CNRS/CONICET, Argentina.

Heinrich Stadials (HS) are abrupt millennial–scale climate change events marked by an anti-phase interhemispheric temperature pattern which is usually termed the bipolar seesaw. HS of the last deglaciation (HS1 and the Younger Dryas) were accompanied by marked increases in atmospheric CO_2 (CO_{2atm}) and decreases of its stable carbon isotopic ratios ($\delta^{13}CO_{2atm}$) with a presumable oceanic source. The occurrence of $\delta^{13}C$ minima during HS1 in planktonic foraminiferal records from the Indo–Pacific Ocean, Southern Ocean, and South Atlantic Ocean has been suggested. However, information on the preceding HS during the last glacial period is scarce. Here we present $\delta^{13}C$ records from two species of planktonic foraminifera (*Globigerinoides ruber* white and *Globorotalia inflata*) from a high temporal resolution marine sediment core (GeoB6212-1), collected near 32° S off south–eastern South America (SESA) that reveal major negative anomalies (up to 1‰) during HS3 and HS2. The planktonic foraminiferal $\delta^{13}C$ anomalies are most likely related to millennial–scale periods of a sluggish Atlantic meridional overturning circulation and the consequent increase in CO_{2atm} and decrease of $\delta^{13}CO_{2atm}$. We hypothesize two main mechanisms that could account for the negative anomalies observed in our records: (i) a strengthening of Southern Ocean deep water ventilation; and (ii) a weakening of the biological pump. Air–sea gas exchange could have acted as secondary modifier and contributed to the negative anomalies. Together with other lines of evidence, our data are consistent with the hypothesis that the CO_2 added to the atmosphere during abrupt millennial–scale climate change events of the last glacial period originated in the ocean and reached the atmosphere by outgassing. The temporal evolution of $\delta^{13}C$ during HS in our records is characterized by a "w–structure" that is also found in North Atlantic and South American records, giving us confidence that such structure is a pervasive feature of HS2 and, possibly, also HS3.

Keywords: Planktonic foraminifera; last glacial; Atlantic meridional overturning circulation.

Acknowledgements: M. C. Campos acknowledges the financial support from FAPESP (grants 2013/25518-2 and 2015/11016-0), and C. M. Chiessi acknowledges the financial support from FAPESP (grant 2012/17517-3) and CAPES (grants 1976/2014 and 564/2015). H. Kuhnert, S. Mulitza and I. Voigt were funded through the DFG Research Centre/Cluster of Excellence "The Ocean in the Earth System". A. R. Piola was funded by grant CRN3070 from the Inter-American Institute for Global Change Research through the US National Science Foundation grant GEO-1128040.