Geophysical Research Abstracts
Vol. 20, EGU2018-12477, 2018
EGU General Assembly 2018

The Biological Pump in the Southern Indian Ocean: Changes and Impacts over the Last 150 Thousand Years

Lena M. Thöle (1), Alfredo Martínez-García (2), Eri Amsler (1), Alexandra Auderset (2), Anja Studer (2), Jörg Lippold (3), Julia Gottschalk (1), Alain Mazaud (4), Elisabeth Michel (4), and Samuel L. Jaccard (1)

(1) University of Bern, Institute of Geological Sciences and Oeschger Centre for Climate Change Research, Switzerland (lena.thoele@geo.unibe.ch), (2) Max Planck Institute for Chemistry, Climate Geochemistry Department, Mainz, Germany, (3) Institute of Earth Sciences, University of Heidelberg, Heidelberg, Germany, (4) Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Gif-sur-Yvette, France

Glacial-Interglacial climate oscillations were characterized by large changes in the partitioning of CO_2 between the ocean interior and the atmosphere due to variations in both physical and biogeochemical processes centered in the Southern Ocean. Vertical mixing/upwelling close to Antarctica brings CO_2- and nutrient-rich waters to the fertile surface ocean releasing carbon dioxide to the atmosphere, whereas export production contributes to sequester CO_2 to the ocean interior. The relative contribution of these two components modulates the net air-sea CO_2 flux on centennial- to millennial timescales. A modification in the balance between these two mechanisms has been proposed to have altered atmospheric CO_2 concentrations in the past and hence contributed to the pCO_2 variations recorded in Antarctic ice cores. Results from the Atlantic basin, however, suggest contrasting trends in export production between the Antarctic and Subantarctic zones.

To further disentangle the nature and impact of these processes and to test the paradigm that has emerged based on paleoceanographic reconstructions largely focused on South Atlantic sedimentary archives, we present new sediment records from the Southern Indian Ocean, a region that until now has largely been undersampled. Our results from the Kerguelen area thus provide a more complete picture of past Southern Ocean dynamics. We report ^{230}Th-normalized export production fluxes on two highly resolved sediment cores, spanning the polar to subantarctic zones, in order to reconstruct export production changes since the penultimate glacial period. Additionally, detrital input proxies such as ^{232}Th, n-alkanes and iron fluxes help to evaluate a possible fertilizing effect on export production by iron-bearing dust. This approach provides important new constraints to further document changes in the efficiency of the biological pump, identifying driving mechanisms such as iron fertilization and nutrient cycling and accompanying changes in the dynamics in the Southern Indian Ocean. This will allow for comparisons with previously published records from the South Atlantic and Antarctic ice records.