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Coupled marine silica and carbon cycle changes after the Palaeocene Eocene Thermal Maximum

YUHAO DAI[1,2], ZHOULING ZHANG[3], SYLVAIN RICHOZ[1], DR. KRISTIN DOERING[1], FRANZISKA M. STAMM[4], JIMIN YU[5], PROF. ZHAOKAI XU SR., PHD[6], MARTIN FRANK[3] AND DANIEL J. CONLEY[1]

[1]Lund University
[2]The Australian National University
[3]GEOMAR Helmholtz Centre for Ocean Research Kiel
[4]Institute of Applied Geosciences, Graz University of Technology
[5]Laoshan Loboratory
[6]Institute of Oceanology, Chinese Academy of Sciences

Presenting Author: yuhao.dai@anu.edu.au

The Palaeocene Eocene Thermal Maximum (PETM) is a hyperthermal event about 56 Ma ago when the Earth's climate rapidly warmed due to release of massive amount of carbon into the atmosphere and ocean. It remains unknown how the carbon released during the PETM was removed from the ocean-atmosphere system, leading to cooling of the Earth's climate after the PETM. One possible mechanism for the carbon removal is the strengthened terrestrial silicate weathering that leads to enhanced carbonate burial on the seafloor. However, evidence is lacking to link changes in riverine silicate weathering flux and seawater carbonate chemistry during the recovery of the PETM. Here, we provide a paired reconstruction of the silica and carbon cycle changes in the Southern Ocean after the PETM. Silicon isotopes in radiolarian at our site progressively shifted towards negative values over a few hundred of thousand years after the PETM. Such a change is likely linked to isotopically more negative riverine inputs attributable to enhanced silicate weathering. Furthermore, the surface silica cycle change is coupled with more calcite-saturated deep water recorded by benthic foraminifera at the same site, which likely indicates enhanced seawater alkalinity and/or lowered dissolved inorganic carbon concentration after the PETM. Taken together, our reconstruction provides critical evidence for the silicate weathering feedback's role in carbon removal after the PETM on timescales longer than a hundred thousand years.