Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18334

A new perspective on the MECO 'Carbon Cycle Conundrum': $d^{30}Si$ records from multiple sites.

RUCHI .[1], MICHAEL J. HENEHAN[1,2], DR. PATRICK J. FRINGS[3], OLLIE LAUB[4], DONALD PENMAN[4], DANIEL A. FRICK[1,5] AND FRIEDHELM VON BLANCKENBURG[3]

[1]Deutsches GeoForschungsZentrum GFZ
[2]University of Bristol
[3]GFZ German Research Centre for Geosciences
[4]Utah State University
[5]Kiel University

Presenting Author: ruchi@gfz-potsdam.de

While the silicate weathering feedback is thought to be a key factor in stabilizing atmospheric carbon dioxide over tectonic timescales, the potential for secular variation in the sensitivity of this feedback over shorter timescales is not yet fully understood. A recent interpretation of the weathering-sensitive isotope system $^{187}Os/^{188}O$ suggested a weakening of the feedback over a ~500 kyr global warming period known as the Middle Eocene Climate Optimum (MECO) (van der Ploeg et al. 2018). However, a feasible driver for any such transient weakening, and for the subsequent reinvigoration of the feedback during MECO cooling, is unclear. Here, we interrogate the idea of a weakened silicate weathering feedback as a driver of the MECO using high-resolution Si isotope measurements from planktic radiolarians and benthic sponge spicules. By combining both the archives, we can glean information about global weathering intensity and paleo circulation (e.g. Fontorbe et al. 2016, 2017).

Here we present data from the southwestern Pacific (IODP Site U1511), Demerara Rise, north Atlantic (ODP Site 1260), and Blake Nose, western North Atlantic (ODP Site 1051) from 39.7 – 41.2 Ma. We find that radiolarians show limited change in $d^{30}Si$ during the event, which likely speaks against extreme changes in continental weatherability over the MECO. In contrast, benthic sponges record major shifts in $d^{30}Si$ at this time, with responses differing in each ocean basin. We suggest that these contrasting patterns most likely indicate a change in global thermohaline circulation patterns.

[1] Fontorbe, G., Frings, P. J., De La Rocha, C., Hendry, K. R., & Conley, D. J. (2016).

Silicon depleted North Atlantic since the Palaeogene: Evidence from sponge and radiolarian silicon isotopes. *Earth and Planetary Science Letters*, *453*, 67-77.

[2] Fontorbe, G., Frings, P. J., De La Rocha, C., Hendry, K. R., Carstensen, J., & Conley, D. J. (2017). Enrichment of dissolved silica in the deep equatorial Pacific during the Eocene–Oligocene. *Paleoceanography*, *32*(8), 848-863.

[3] van der Ploeg, R., Selby, D., Cramwinckel, M. J., Li, Y., Bohaty, S. M., Middelburg, J. J., & Sluijs, A. (2018). Middle Eocene greenhouse warming facilitated by diminished weathering feedback. *Nature communications*, *9*(1), 1-10.