

## **Silicate weathering vs. organic carbon burial: Who wins?**

**Dominik Hülse<sup>1,2</sup>, Andy Ridgwell<sup>2</sup>**

<sup>1</sup>MARUM – Center for Marine Environmental Sciences, University of Bremen, Bremen, Germany

<sup>2</sup>Department of Earth and Planetary Sciences, University of California, Riverside, CA, USA

Negative feedback between climate and atmospheric CO<sub>2</sub>, as mediated via weathering of silicate minerals, is thought to provide the dominant regulation of Earth's climate on geological timescales. In contrast, we show here that faster and more responsive feedbacks involving organic matter are not only critical to Earth system recovery from climate perturbation but can also create unexpected instability in the system. Specifically, using an Earth system model, we show how sedimentary organic carbon burial, amplified by climate-sensitive phosphorus feedbacks, can dominate over silicate weathering, paradoxically creating a cooler climate state in response to massive CO<sub>2</sub> release. This carbon-climate instability is most strongly expressed in the model at intermediate ocean redox states, which may help understand the timing of ice ages through Earth's history.