

Silicate Weathering vs. Organic Carbon Burial: Who Wins?

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Negative feedback between climate and atmospheric CO₂, 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 feedbacks involving organic matter are critical and create unexpected instability in the system. Specifically, using an Earth system model, we show how sedimentary organic carbon burial, amplified by redox-sensitive phosphorus regeneration feedbacks, can dominate over silicate weathering, paradoxically creating a cooler climate state in response to massive CO₂ 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.