

EGU22-7744

<https://doi.org/10.5194/egusphere-egu22-7744>

EGU General Assembly 2022

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Hafnium-neodymium isotope evidence for enhanced weathering and tectonic-climate interactions during the Late Cretaceous

Pauline Corentin¹, Emmanuelle Pucéat¹, Pierre Pellenard¹, Michel Guiraud¹, Justine Blondet¹, Nicolas Freslon², Germain Bayon³, and Thierry Adatte⁴

¹Université de Bourgogne Franche-Comté, Laboratoire Biogéosciences, Dijon, France (pauline.corentin@u-bourgogne.fr)

²ISTO - Université d'Orléans, CNRS, BRGM, UMR 7327, France

³IFREMER, Unité de Recherche Géosciences Marines, France

⁴Institute of Earth Sciences, Géopolis, University of Lausanne, Switzerland

Over million-year timescale the carbon cycle evolution is driven by mantle CO₂ degassing (source) and by continental weathering that drawdowns atmospheric CO₂ through silicate weathering reactions (sink). Based on a novel geochemical proxy of chemical weathering intensity (i.e. using measurements of Hf and Nd isotope ratios in clay-size fractions of sediments) and clay mineralogy, we discuss the links between tectonic, continental weathering and climate evolution during the late Cretaceous. That period records the very first step of the last greenhouse to icehouse transition and is concomitant to major uplift phases affecting the African and South-American margins.

Two sites along the South American Atlantic margin (ODP 356 and 1259) were targeted based on their relatively complete record of upper Cretaceous sediments. At Site 356, our results indicate the occurrence of enhanced chemical weathering during the Campanian and Maastrichtian following the uplift of the Southeastern Brazilian margin that promoted the establishment of more hydrolysing conditions.

At Demerara Rise (Site 1259), our data suggest a coupling between physical erosion and chemical weathering, which may be explained in this area by the presence of persistent hydrolysing conditions typical of equatorial climate and reduced tectonic activity. From the Turonian to the early Campanian, i.e. a period of relative tectonic quiescence, our data suggest that climate was likely the main driver controlling the evolution of chemical weathering intensity. By contrast, from the middle Campanian to Maastrichtian, we propose that mountain uplift, although moderate, induced a marked increase in chemical weathering intensity.

Together, this new data acquired at two 2 sites that encountered different regional climatic, geologic and tectonic conditions suggest that chemical weathering markedly intensified during the late Cretaceous and likely acted as a major sink for atmospheric CO₂. While the onset of weathering increase at both sites appear to postdate the initiation of global temperature decrease, we suggest here that this process could have participated to accelerating or maintaining colder climate conditions at that time.

Key Words: late Cretaceous – paleoclimate – weathering – uplift - clay mineralogy – Hf-Nd isotope