Evolution of weathering and erosion in the South Atlantic during the Late Cretaceous

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The Late Cretaceous period is marked by a long-term climatic cooling (FRIEDRICH et al., 2012) and by major geodynamic changes, that include modifications in the direction and velocity in the African plate motion toward Eurasia (GUIRAUD & BOSWORTH, 1997). During the Senonian, the African continent underwent a major uplift event, that is most pronounced in its southern part (GUIRAUD & BOSWORTH, 1997; BRAUN et al., 2014). These geodynamical changes may have led to modifications in weathering and erosion rates, that may have initiated or enhanced the recorded long-term cooling through CO_2 drawdown linked to silicate weathering.

In order to explore the possible links between uplift in south Africa, continental weathering, and climate, we performed analyses of clay mineral assemblages and of a new proxy of local continental weathering, the combined Lu-Hf and Sm-Nd isotope systems in clays (BAYON et al., 2016), on sediments from DSDP site 364 in the Angola Basin. About 100 analyses of clay mineral assemblages have been conducted that display a marked increase in illite, chlorite, and kaolinite proportions during the Santonian-Campanian interval dominated by a smectite-rich sedimentation. We interpret this evolution as reflecting increased mechanical weathering of nearby crustal material. About 20 analyses of combined Hf isotopic (ε_{Hf}) and Nd isotopic (ε_{Nd}) compositions of part of the sample set have additionally been realized. These newly acquired data display a decrease in the ε_{Nd} composition of the eroded material transported to site 364, from values of about -15 ε-units in the Turonian to Santonian interval, to values of about -22.5 ε-units on average during the Campanian and Maastrichtian. A concomitant increase in Deltaε_{Hf} values, representing deviation from the clay array of the ε_{Hf} values of clay-size sediments (BAYON et al., 2016), suggests an increase in chemical continental weathering during the Santonian-Campanian. We link this concomitant change in clay mineral assemblages, clay ε_{Nd}, and clay Deltaε_{Hf} values during the Santonian-Campanian interval to the uplift event of South Africa. This event could have induced both erosion of more ancient underlying crustal material and an increase in mechanical weathering, that itself could have favored an increase in chemical weathering.

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