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# Evolution of weathering and erosion of the Angola margin : did tectonic uplift of the African Plateau trigger the late Cretaceous cooling?

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The Late Cretaceous period encountered a long-term climatic cooling, which could be considered as the first step of the progressive climatic decline that ultimately led to our modern climate mode with its ice-sheets covering both poles (Friedrich et al., 2012). Identifying the processes that drove this first cooling step thus represents a challenge for our comprehension of the last greenhouse to icehouse transition. This cooling occurred at a time of important geodynamic changes including a major uplift phase of the African continent. This uplift is most pronounced in its southern part, with total amount of denudation of several km reported along the western African margin, most of the exhumation occurring within the 90-60 Ma interval (Gallaghuer and Brown, 1999; Raab et al., 2005). This pulse of uplift could have led to changes in weathering and erosion rates, and act as a trigger for the late Cretaceous climate decline through $CO_2$ consumption by enhanced silicate weathering.
We present in this work a new record of chemical weathering evolution of the Angola margin using a novel proxy, $\Delta\varepsilon$Hf clay, based on the combined neodymium and hafnium isotopic composition of clay-size sediment fractions (Bayon et al., 2016) that have been recovered from marine sediments of the DSDP site 364 in the Angola Basin. Our new data highlight a drastic increase in chemical weathering intensity of the Angola margin in the Santonian and Early Campanian, that is concomitant to the main cooling phase of the late Cretaceous (Friedrich et al., 2012). We additionally approached the evolution of mechanical erosion using illite/smectite ratios, inferred from additional clay mineral analyses of sediments from the same DSDP core. Clay mineralogical data highlight an increase in mechanical erosion as well from the Santonian onward, linked to tectonic uplift of the Angola margin, with a climax recorded around the Middle-Late Campanian boundary. Interestingly, our data show that chemical weathering represented by $\Delta\varepsilon$Hf increasing together with enhanced mechanical erosion inferred from illite/smectite ratios, but becomes decoupled from erosion after a threshold is crossed, as has been observed in modern environments at high denudation rates (Gabet and Mudd, 2009).
Importantly, the temporal correspondence between the depicted increase in chemical weathering of the Angola margin with the main late Cretaceous cooling phase strongly hints to a potentially major role of African Plateau uplift on climate. The extent of the south Africa area affected by enhanced chemical weathering processes now remains to be determined by additional records along the African margin.

References :
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