Hf and Nd isotope records of West African monsoon precipitation in sediments from the Niger Delta

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The Niger River basin is characterized by a strong north to south precipitation gradient, encompassing several climatic zones from the arid Saharan desert to the Adamawa tropical highlands in eastern Nigeria. The precipitation patterns over the Niger Basin are linked to the northward migration of the InterTropical Convergence Zone (ITCZ) during northern summer, which controls the West African monsoon. To assess past precipitation changes in the Niger Basin during the Late Quaternary is important for better understanding the factors controlling West African monsoon climate. Here, we report Hf and Nd isotope compositions in marine sediments collected off the Niger River. Core N1-KSF-39 was recovered from the Niger Delta, at 1200 m water depth, providing a continuous record of the Niger sediment discharge over the last 70,000 years. Nd isotopic analyses of the terrigenous fractions provide quantitative information on the geographical provenance of the sediment. In contrast, the Hf isotopic composition of clays can be used as a proxy for silicate weathering intensity [1]. The decoupling between Hf and Nd isotopes during weathering is clearly illustrated in the !Hf vs. !Nd diagram [1], where four distinct arrays can be recognized: 1) the ‘igneous rock array’, corresponding to unweathered silicate rocks; 2) the ‘sand array’, formed by all zircon-bearing coarse-grained sedimentary rocks; 3) the diffuse ‘clay’ array; and 4) the ‘seawater array’ defined by marine ferromanganese precipitates. Both Nd and Hf isotope ratios exhibit marked down-core variations over interglacial vs. glacial timecales, which indicate abrupt changes in the provenance of the material delivered by the Niger River. In addition, the deviation of !Hf relative to the ‘clay array’ ($clay!Hf) also follows closely the Late Quaternary climatic trend, providing a record for silicate weathering intensity in the Niger Basin. Both provenance and silicate weathering proxies can be directly related to abrupt changes in West African monsoon precipitation and associated reorganizations of the Niger River system.