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Constraints on the provenance and weathering rates of atmospheric dust from the U and Nd isotopic compositions of carbonate and silicate phases

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Atmospheric dust plays a key role in shaping global climate by affecting the radiation budget, modulating precipitation, and serving as a significant source of limiting trace metals to the oceans (e.g., Fe). At present, the primary source of atmospheric dust in the World is from the Sahara-Arabia desert belt. The mineral composition of dust varies both spatially and temporally, but can be generally divided into an Al-silicate phase, a carbonate phase and a water-labile phase, which often includes sea salts and anthropogenic elements.

Here, we report the composition of ($^{234}U/^{238}U$) and εNd, together with trace element concentrations of the Al-silicate and carbonate phases of dust samples collected in the Gulf of Aqaba, northern Red Sea, between the years 2009-2019. The sampling site is located between the Sahara and the Arabia Deserts and is exposed to frequent dust storms, whose source is identified through air mass back trajectories. While εNd values reflect the source composition, the ($^{234}U/^{238}U$) ratio is sensitive to the weathering history of the samples, which reflects the combined effects of their provenance, transport pathways and chemical weathering rates. Combined with new and published dust trace element compositions, we will discuss the characteristic weathering history of dust from distinct geographic sources across the Sahara-Arabia Deserts, and evaluate the implications for interpreting dust records in geological archives.