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Controls on aolian particulate trace element geochemistry within the Sahara-Sahel Dust Corridor

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Dry air outbreaks from Africa between latitudes 15^o-25^oN commonly carry vast amounts of aeolian mineral particles westwards to the Atlantic, Caribbean and America. These dust intrusions usually source either from the central Sahara-Sahel Dust Corridor (SSDC), a huge zone lying between latitudes 12^oN-28^oN and running 4000km E-W from Chad to Mauritania, or originate from the northwestern African Coast. These atmospheric outbreaks merge into the Saharan Air Layer between latitudes 10^o-25^o and commonly travel to the other side of the ocean, retaining their identity for over a week. Atmospheric dust carried by these dry air outbreaks affects outgoing longwave radiation, and some minerals (e.g. iron oxides) are more light absorbtive than others. XRD, SEM-FESEM, ICP-AES and ICP-MS data on samples from Western Sahara, Algeria, Chad, and Niger were obtained to investigate how corridor dust trace element chemistry might vary with geological source and weathering/transport history. Dusts sourced directly from "hard rock" igneous and metamorphic massifs are geochemically immature, retaining soluble cations (e.g. Rb, Sr) and accessory minerals containing HFSE such as Zr, Hf, U, Th and REE. In contrast, silicate dust chemistry in desert basins such as the Bodélé Depression is influenced by a longer history of transport, physical winnowing (which can induce loss of Zr, Hf, Th), chemical leaching (removing for example Rb), and mixing with intrabasinal materials such as evaporitic salts and diatoms. Mineral aerosols carried along the SSDC by the winter Harmattan winds mix these "hard rock" basement and "soft rock" basinal materials. Dusts brought into the SSDC from sub-Saharan Africa during the summer

monsoon derive from deeply chemically weathered terrains and thus tend to be more kaolinitic and stripped of mobile elements such as LILE, but retain immobile and resistant elements such as Zr, Hf, REE. Aeolian dusts transported southwestwards into the SSDC from along the Atlantic Coastal Basin are enriched in carbonate derived from Mesozoic-Cenozoic marine limestones and depleted in Th, Nb and Ta. Long range transport of these dusts across the ocean will inevitably tend to alter the bulk aerosol chemistry by mixing and size fractionation, thus obscuring geological signatures from specific source areas. It remains uncertain, however, to what extent African dust populations carried rapidly westwards by dry air outbreaks can retain a recognisable "geological" signature and, if so, whether such subtle compositional differences could influence physical interaction of these aeolian dusts with the atmosphere over the ocean.