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Effects of source variations and biomass burning on organic and inorganic signatures of aerosols collected off West Africa

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Aerosol samples were collected during July/August 2003 along the West African coast from the Canary Islands to South Africa using High Volume Air samplers onboard *RV* Marion Dufresne. At this time the Intertropical Convergence Zone (ITCZ) was far north with its surface expression at 10ºN. Satellite images (TOMS) show that prominent westward aerosol transport occurred over NW Africa, likely dominated by inorganic dust. South of the ITCZ, strong SE trade winds transported high amounts of aerosols from southern central Africa northwestward. Their origin is, however, more likely related to biomass burning, as suggested by satellite fire sightings (MODIS).

Elemental analyses confirm that the majority of the inorganic material is transported at 15ºN within the NW African dust plume, with smaller maxima off central and SW Africa. Major elemental abundances suggest three distinct source areas: dust from NW Africa is characterized by high Al, high Mg and low K concentrations, dust off central Africa exhibits low Al, moderate Mg and high K concentrations, and SW African dust is low in Al, high in Mg and moderate in K. This pattern may reflect the weathering and therefore climate zonation along the West African coast.

Organic geochemical analyses reveal terrestrial plant waxes as abundant lipid compounds in the aerosols. Their concentrations are low off NW and SW Africa, but elevated in the tropical African aerosols, likely due to a higher vegetation density, strong SE trade winds and biomass burning. Within a distinct aerosol event off central Africa, their concentrations increase more than threefold, concomitant with an increase of inorganic elemental concentrations. Their compound-specific stable carbon isotopic signatures indicate predominant C4 plant (tropical grasses) sources off NW and SW Africa, and generally high C3 plant (rainforest trees) contributions off tropical Africa. Interestingly, a distinct pattern in the stable carbon isotopic compositions of individual plant-wax fatty acid homologues is observed. While stable carbon isotope values of longer-chain fatty acids decrease with increasing chain length in aerosols off NW and SW Africa, they consistently increase with chain length in aerosols emanating from tropical W Africa. This observation contrasts with expected latitudinal trends based on vegetation belts on the adjacent continent. These relationships may reflect the influence of biomass burning on the isotopic compositions of fatty acids derived from C4 and C3 plant.