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A control of seasonality on volcanic ash soil weathering and erosion

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With the aim to compare material storage in catchment ash soil and losses downward the sedimentary realm, rock magnetic measurements and complementary analyses have been performed on soil, saprolite and shoreline samples and deep-lake sediments from the Masoko maar-lake basin and surrounding highlands in southern Tanzania. In such volcanic ash environments, outstanding hydric conductivities considerably restrict the impact of surface erosion and incision processes. Instead to be defined from “saprolitic” or “C” horizons, the parent “unweathered” material (PUM) signature has been defined from a set of pre-lacustrine deposits and well preserved ash layers from drilled deposits.

Comparison of weathering profiles with the PUM suggests a relative immobility of Fe-Ti oxides, which explain the high soil ferrimagnetic enhancement along the toposequence. In humid forested areas/time intervals, surface erosion /transportation processes of primary (Ti-)magnetite is almost confined in a lake shore “line” area, and controlled by seasonal changes in water-table, while dissolved or colloidal inputs seem highly stabilized. Erosion of this titanomagnetite reservoir strengthens under relatively drier conditions of the Late Pleistocene and Holocene, especially when pollen assemblages indicate a relative increase in grass cover.

Strikingly, the inputs of dissolved and colloidal siliceous material show similar changes, suggesting that ash weathering primarily responded to increasing seasonality and aridity. Taken together, these results support an overwhelming control of weathering, erosion and sedimentation by the amplitude of the seasonal hydrological cycle

and the associated temporal fluctuations in water availability.

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