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Climatic Cyclicity revealed by Rock Magnetism: an Example from Saharan Dust trapped on Lanzarote (Canary Islands)

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Magnetic properties of sediments and soils are nowadays widely used in Quaternary and palaeoclimatic research to characterise the palaeoenvironment and to date indirectly sedimentary sequences. Quaternary dust deposits like loess/palaeosol sequences provide valuable palaeoclimatic information from areas, where other archives are rare or even absent. Wind blown dust was deposited worldwide during the cold/dry periods of the recent geological past. It undergoes pedogenesis when more humid conditions predominate, which is reflected in physical-chemical alteration of the sediment. These alterations result in the enhancement and transformation of magnetic minerals. Especially the so called ferromagnetic minerals (s.l.) react in ambient laboratory magnetic fields orders of magnitude stronger than other iron-bearing minerals. Thus, already very tiny concentration changes of these minerals control the magnetic signal of a sediment or soil. Therefore, magnetic parameters as function of depth can serve as a proxy for palaeoclimatic variations allowing for a close match with all kinds of high resolution palaeoclimatic archives.

On Lanzarote (Canary Islands), sediment was trapped in Miocence to Pliocene valleys dammed by younger volcanic material. The sedimentary infill of these valleys largely consists of Saharan dust but contains also volcanic slope debris of the local catchments. The sections reveal a regular alternation of almost unweathered sediments with strongly rubified palaeosol-complexes. Direct age controlled is provided by luminescence dating giving an age range from recent to approx. 200 ka.

Rock magnetism exhibits a very regular almost sinusoidal cyclic pattern for all investigated sections. This regular cyclicity probably reflects semi-continuous

high frequency and low amplitude depositional events accompanied by diagenetic/pedogenetic processes. The latter seem to control the magnetic signal. Thus, rock magnetism record on-site humidity changes and hence the palaeoclimatic history of Lanzarote, rather than the palaeoclimate of the source area of the Saharan dust. Direct field observations as well as sedimentological, pedological and geochemical data corroborate this interpretation.