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Magnetic characteristics of aeolian and fluvial sediments and onset of dust accumulation at Lake Yoa (northern Chad) during the Holocene

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The Holocene is a period of fundamental climatic change in North Africa. Humid conditions during the Holocene Humid Period have favored the formation of big lake systems (e.g. Lake Megachad) and are evident in terrestrial and marine archives. Only very few of these lakes persist until today. One of them is Lake Yoa (19°03′N/20°31′E) in the Ounianga Basin, Chad, which maintains its water level by ground water inflow.

Here we present the magnetic characteristics of a continuous 16 m long sediment record (Co1240) from Lake Yoa, retrieved in 2010 within the framework of the Collaborative Research Centre 806 – Our Way to Europe (Deutsche Forschungsgemeinschaft). The sedimentary section covers the past 11,000 years. In an earlier core (Kröpelin et al. 2008), a humid climate during the Mid-Holocene is indicated by fresh-water conditions in the lake. At about 4,000 cal. years BP, a fresh-to-saline transition is reflected in the record. However, a major rise in magnetic susceptibility, interpreted as an increase in the accumulation of wind-blown material, is only visible after 3,000 cal. years BP.

Beyond using the concentration of magnetic minerals (susceptibility), environmental magnetic proxies, e.g. magnetic grain size and the composition of the magnetic mineral fabric, are often used as paleoenvironmental indicators. The underlying assumption is that the formation of magnetic minerals during pedogenesis is catalyzed by precipitation and soil-temperature. The application of magnetic proxies as reliable climofunctions has, however, recently been challenged. Possible problems are that soil formation might not reach an equilibrium state if climate perturbations are too short (e.g. hundreds of years) or that other variables such as soil organic carbon and vegetation have varied.

In this study, we will focus on the variability of magnetic parameters in Lake Yoa sediments and its implication for the regional environmental development throughout Holocene times. 400 discrete samples will be analyzed using a cryogenic magnetometer. The magnetic grain size will be used to identify the initiation of increased accumulation of aeolian material. By analyzing Isothermal Remanent Magnetization acquisition curves, fluvial and aeolian end-members will be characterized in terms of magnetic mineralogy. Furthermore, a possible climate-induced impact on the formation of pedogenetic magnetic minerals in the source area of fluvial and aeolian sediments will be evaluated by a comparison of the environmental magnetic with organic proxies.