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XRF core scanner measurements as proxies for terrigeous material and lithogenic grain-size variability: An example of NW African climate conditions during the Late Quaternary

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A common way to reconstruct continental climate conditions in arid to semi-arid regions is by investigating the imprint of lithogenic material in the marine realm due to the lack of severe erosional processes and the large variety of dating methods at hand. Moreover, there is a growing need for high-resolution records that enable the reconstruction of centennial to millennial scale events (e.g. Dansgaard – Oeschger and Heinrich events) to get a better insight in causes and effects of climate changes. We present a climate reconstruction using high-resolution XRF measurements, the proportion lithogenic material, and grain-size distributions of the lithogenic fraction to indicate millennial-scale climate variability during the late Quaternary ($\sim$120 ka) of sediment core GeoB7920-2 off Cape Blanc, NW Africa.

X-ray fluorescence (XRF) core scanning is a fast, cheap and non-destructive way to obtain high-resolution chemical data directly from the sediment surface of a split-core. The influences of physical and chemical properties on XRF measurements – e.g. density, surface roughness and sediment composition – are only weak, but the water content can have a strong imprint on the measurements of light elements in soft marine sediments. We present a model to correct for the water absorption effect of XRF radiation to further improve high-resolution XRF measurements of the element Silicium (Si) in core GeoB7920-2. Furthermore, we validate the Si element intensities to predict variations of the bulk lithogenic fraction as measured by removing all organic material, calcium carbonate and biogenic opal. In addition, the Zirconium-Potassium

ratios (Zr/K) calculated from XRF core scanner measurements are in good agreement with the sand-sized faction of the lithogenic material.

Our data show an in-phase link between the variations in high-latitude temperature variations and low-latitude climate changes. Off Cape Blanc, periods of enhanced lithogenic input and a strong decrease of the lithogenic fine-silt fraction co-occur with millennial-scale stadial periods as observed in the NGRIP ice core. We interpreted these millennial-scale changes of lithogenic input and grain-size composition as climate variations related to changes in the hydrographical conditions off NW Africa and superimposed on the African monsoonal climate.