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Nature and origin of fine laminated sediments from the western Nile Delta: high-resolution elemental content and lithology

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The Nile deep-sea fan is a key location to study the temporal variations of both North African climate and Mediterranean hydrology. Prior to the construction of a large dam on the upper Nile River, terrigenous and marine sediments accumulated at rates of up to 150 cm/ka, allowing the preservation of a high-resolution climatic record. Moreover, the sediment delivery shows a strong seasonal variability, with detrital material transported during summer and autumn floods and biogenic carbonates deposited during winter and spring productivity blooms.

Using a 6 m-long sediment core retrieved at 700 m water depth on the upper slope of the western Nile deep-sea fan (R/V Poseidon cruise P362/2), we aim at reconstructing the sedimentary dynamics during the Holocene. Below 70 cm of non-laminated oxidized sediments, millimetre-scale laminations (alternating dark-coloured and light-coloured silty-clay layers) develop and are fully expressed between 140 cm and the bottom of the core. A first set of 5 AMS-^{14}C ages indicates that the laminated interval was deposited between 9500 and 7800 cal. yr BP. This corresponds to a sedimentation rate of $\sim$2 mm/yr and implies that the laminations could record seasonal variations. In addition, the laminated interval corresponds to the deposition of sapropel S1 in the Mediterranean basin. Sapropel S1 has been related to the precession-forced maximum of the African Monsoon and oxygen depleted Mediterranean bottom water.

Non-destructive core logging techniques (MSCL, XRF core scanning) have been applied to resolve the seasonal changes in sediment composition at centimetre- and sub millimetre-scale. We use the relative variations of Ca and Ti obtained by the XRF core scanner to trace the variations of terrigenous and marine contributions. Long-term variations indicate relatively high terrigenous contribution in the laminated part of the core, which strongly decreases in the non-laminated top part of the core. This might be related to channel migrations on the paleo Nile delta at about 5000 BP although this is not confirmed by ^{14}C dates yet. The elemental contents at 0.3 mm-resolution clearly indicate a strong increase of terrigenous material in the dark-coloured laminae with respect to the light-coloured laminae. As such, we relate the dark-coloured laminae to large scale flooding of the Nile during the summer-autumn monsoon season, and the light-coloured laminae to winter-spring bloom in the surface waters. Changes in frequency and amplitude of Ti/Ca ratios are visible, suggesting variations in seasonality through time. This will be further explored using time-series analysis tools.