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Climatic fluctuations during the Holocene based on eastern Mediterranean continental shelf sediment cores

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Sediments deposited on the south eastern Mediterranean continental shelf are sensitive recorders of climatic and oceanographic variability affected by the north Atlantic and indirectly by monsoonal systems. In order to reconstruct the influence of these climatic systems two cores were taken off shore the southern and central Israeli coast at water depths of ∼35 m. The sediments were characterized by majors and traces elements, and the sediment provenance was determined using $^{87}Sr/^{86}Sr$ ratios. Detrital input from the Nile and local environment was studied using grain size distribution and sedimentation rates. Water column productivity was inferred by TOC and $\delta 13C_{org}$.

The cores, dated to 7,630 and 8,440 ^{14}C years BP, show two distinct sedimentation regimes. The early Holocene is characterized by high sedimentation rates (190-140 cm/ka) that decrease in the last 5,500 years (50-60 cm/ka) in both north and central cores. Coarse grain size is dominant in the early Holocene, with a decreasing trend in the northern core. This distribution is probably connected to eustatic sea level rise and recycling of coarse sediments from the flooded shallow Nile cone. In the late Holocene, as sea level stabilized, grain size is finer in the south; while to the north, cycles of ∼1,500 years in coarse grain size characterize the period.

Carbonate and organic carbon further present the change along the period. Decrease in carbonate content and increase in $\delta 13C_{org}$ during the late Holocene indicate decrease in water column productivity. In contradiction, organic carbon is relatively high in the late Holocene. This is explained by the coarse sediment texture in the early Holocene leading to better oxidation of buried organic matter.

Strontium isotopes show changes in sediment provenance. In the early Holocene high $^{87}Sr/^{86}Sr$ values of ∼0.71 reflect a dominant signature of the White Nile and the Yellow Nile and in part the local streams. During the last 5,500 years lower values of ∼0.7074 in the southern core compared to ∼0.7080 in the northern core, reflect a strong finger print of the Blue Nile on the sediments adjacent to the Nile cone that rapidly disappear northwards.

The changes in the geochemical and sedimentary proxies are connected to Holocene climatic fluctuations. Change of provenances and decrease of fluvial input to the basin and in water column productivity around 5,500 years BP occur simultaneously with changes in the intensity of the monsoonal system over the headwaters of the Nile. These changes, that are present both at southern and central inner shelf, can be connected to the end of the African humid period. In the late Holocene, as the influence of the Nile on the central part of the shelf decreases, the Mediterranean climate system that originates in the northern hemisphere climate system is more evident. Cycles of ∼1,500 years of coarse sediments probably originating from erosion in the coastal environment correlate with cold events known as the north Atlantic Bond cycles. Our results show the potential of shelf sediments to record and understand the control of climatic global systems on inner shelf sediment records.