



The Early Holocene Humid Period in N Arabia – proxy evidence from a unique varved lake record

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There is growing interest in deciphering the hydroclimatic dynamics on the Northern Arabian Peninsula during and after the Early Holocene Humid Period (EHHP) as a key for better understanding the role of climate in driving neolithisation and the evolution of new lifestyles in the poorly studied Arabian Desert. However, our knowledge about the magnitude, timeframe and sources of increased moisture in Northern Arabia during the EHHP is limited due to a lack of robust proxy data.

Here we provide the first high-resolution and precisely dated multi-proxy reconstruction of the hydroclimatic variability during the EHHP for northern Arabia, retrieved from annually laminated (varved) sediments of the Tayma palaeolake record. We found pronounced seasonal variability during the lake's evolution, which we reconstructed through micro-facies analyses of the varved sediments. Changing lake water evaporation and the lake-internal productivity was inferred using stable oxygen and carbon isotope compositions ($\delta^{18}\text{O}$ and $\delta^{13}\text{C}$) of carbonates. The compound-specific hydrogen isotope composition of plant-wax n-alkanes ($\delta\text{D}_{\text{wax}}$) was used as a proxy for changing moisture supply. Our robust age model is well constrained by a floating varve chronology anchored through ^{14}C dating of pollen concentrates and the well-dated 'S1' cryptotephra.

Our results show that slightly wetter conditions started at Tayma at ca. 9300 yrs BP. The highest moisture availability was only achieved during a ca. 600 years lasting deep-lake phase from ca. 8500 to 7900 yrs BP, when varves formed in the lake. This implies that the EHHP was comparably short in northern Arabia. Furthermore, we found a complex regional hydrological pattern during the EHHP on centennial time-scales, which we discuss with respect to alternative moisture sources and mechanisms that led to the observed hydroclimatic signature at Tayma.

This study is a contribution to the research project "CLEAR – Holocene Climatic Events of Northern Arabia" (<https://clear2018.wordpress.com/>).