

The early Holocene humid period in the Tayma palaeolake, NW Arabian Peninsula – A high-resolution micro-facies and geochemical approach

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The Tayma palaeolake is a rare archive of the early Holocene humid period in northern Arabia (Dinies et al. 2015; Engel et al. 2012). Here we present a ca. 1 m thick and 500 years spanning annually laminated sediment section that was deposited in the centre of the former lake from ca. 8500 to 8000 calibrated years (cal. yrs) BP, as determined by AMS ^{14}C dating of pollen concentrates (Dinies et al. 2015). High-resolution micro-facies analyses based on thin section microscopy, μXRF element scanning, $\delta^{18}\text{O}_{carb}$ and $\delta^{13}\text{C}_{carb}$ measurements on single carbonate laminae, as well as geochemical measurements on bulk samples for TOC, CaCO_3 , C/N ratio, $\delta^{18}\text{O}_{carb}$, $\delta^{13}\text{C}_{carb}$, $\delta^{13}\text{C}_{org}$ and $\delta^{15}\text{N}$ determination were performed in order to investigate the sedimentological and geochemical changes along the varved sequence in great detail. The finely laminated marl sediments are mainly composed of sub-mm thick laminae of endogenic aragonite, organic matter and diatoms, as well as occasional, often graded silt-clay layers. Following an early lake phase from ca. 8700 to 8500 cal. yrs BP characterized by coarsely laminated, presumably non-annual marl sediments that are rich in ostracods, three main varved phases can be distinguished within the investigated section: (1) aragonitic-organic varves from ca. 8500 to 8300 cal. yrs BP, (2) diatom-organic varves from ca. 8300 to 8100 cal. yrs BP that frequently include aragonite laminae and occasionally gastropod and ostracod shells, and (3) organic varves from ca. 8100 to 8000 cal. yrs BP with decreasing diatom and aragonite laminae and an increasing frequency of gypsum layers. After this period, gypsum becomes abundant and fine lamination appears only sporadically. In addition, we observe increasing trends of TOC, C/N and $\delta^{13}\text{C}_{carb}$ and decreasing $\delta^{18}\text{O}_{carb}$ during phase 1 and excess $\delta^{18}\text{O}_{carb}$, $\delta^{13}\text{C}_{carb}$ and TOC values during phase 2, pointing towards the maximum lake productivity and increased seasonal precipitation. We interpret this sedimentological-geochemical succession as reflecting a high moisture availability during the early Holocene that culminates at around 8200 cal. yrs BP (phase 2). Stimulated by the coincidence in timing, we will discuss possible relations to the so-called 8.2 ka cold event in the North Atlantic realm.

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

References:

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