Geophysical Research Abstracts
Vol. 17, EGU2015-518, 2015
EGU General Assembly 2015

Lithostratigraphy and microfacies analyses of the Lateglacial and early Holocene sediment record from Lake Haemelsee (Germany)

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Annually laminated sediments are unique continental archives holding essential paleoenvironmental and paleoclimatic information providing the opportunity (i) to evaluate the climate variability at inter-annual to decadal scale and (ii) to construct independent and reliable chronologies.
Lake Haemelsee in northern Germany (19.5 m a.s.l) is a key site for tracing high-resolution climatic and environmental evolution in W Europe because of its partly varved sediments. Here, we apply lithostratigraphical, geochemical and micro-facies analyses for the bottom sediments ($\sim$1700 to 1300 cm sediment depth) in order to investigate the driving mechanisms, timing and amplitude of Lateglacial abrupt climate changes to the onset of the Holocene warming. Detailed investigation includes micro-facies analyses on petrographic thin sections combined with high-resolution μ-XRF element scanning on both fresh sediment core halves (200 μm resolution) and impregnated sediment blocks (50μm resolution). Based on these analyses, the sediment composite profile (378 cm) has been divided in ten lithozones, each exhibiting different sedimentation modes in response to regional and local climatic and environmental changes. Micro-facies analyses revealed that sediments consist of organic matter, siderite, calcite, clay/silt and sand. The basal sediments consist of glacio-fluvial material. Fine laminations are best preserved in lithozone 5 (1522-1573 cm), where minima in element proxies for detrital sediments (Ti, K, Si) and maxima in Fe and Mn indicate the prevalence of anoxic meromictic conditions. Three different varve facies types were distinguished: i) the clastic-organic varves are specific for the intervals 1571-1573 cm and 1536-1541 cm; ii) calcite/siderite-organic varves appear between 1568-1571 and 1541-1545 cm; iii) the siderite-organic varves are characteristic for the middle of the lithozone 5 spanning from 1545-1568 cm. These changes in varve facies reflect the complex answer of sedimentary conditions to climatic changes during Allerød and Allerød/Younger Dryas transition. An increased detrital sediment flux characterizes lithozone 6 and, most probably reflects the Younger Dryas cold interval. This interpretation is supported by the late Allerød Laacher See Tephra, an important chronostratigraphic marker horizon to link the floating 625 varve year chronology for the Allerød interstadial to an absolute time scale. Also, the preliminary pollen data provided the biostratigraphical information for establishing the lateglacial boundaries. Poorly preserved organic laminas are characteristic for lithozone 7 (1445-1474 cm).
Our preliminary results demonstrate that the lake system responded sensitively to rapid and short-term climatic changes and these responses are well-expressed in sedimentological and geochemical variability.