

Refining the time span between the early Holocene Askja-S and Hässeldalen tephras through differential dating based on varve counting from Lake Czechowskie (N Poland)

Florian Ott (1), Sabine Wulf (1,2), Johanna Serb (1), Michał Słowiński (1,3), Milena Obremska (4), Rik Tjallingii (1), Mirosław Błaszkiewicz (3), and Achim Brauer (1)

(1) Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences, 5.2: Climate Dynamics and Landscape Evolution, Potsdam, Germany, (2) Senckenberg Research Institute and Natural History Museum, BiK-F, TSP6 Evolution and Climate, Senckenbergenallee 25, D-60325 Frankfurt a. M., Germany, (3) Institute of Geography and Spatial Organization of the Polish Academy of Sciences, Department of Environmental Resources and Geohazards, 87-100 Toruń, Poland, (4) Institute of Geological Sciences, Polish Academy of Sciences, Research Centre in Warsaw, Twarda 51/55, PL-00-818 Warsaw, Poland

Robust chronological framework is a crucial necessity for palaeoclimate reconstructions and especially for synchronizing records to decipher climatic teleconnections. Volcanic ash deposits (tephra) provide isochronous time marker that can be utilized as tie-lines to synchronize sedimentary archives. Advances in the detection and identification of non-visible (crypto-) tephra, often transported over thousands of kilometers, also allows identifying ash deposits even in distal records. We report the first findings of co-existing early Holocene Hässeldalen and Askja-S cryptotephras in a varved sediment record in Lake Czechowskie (JC, northern Poland). Annual layer counting was used to establish a varve chronology and micro-facies analyses, relative calcium (Ca) and titanium (Ti) concentrations were used to decipher between lake productivity and detrital flux. Here we focus (i) on the determination of the time span between both tephras, (ii) revised age estimates for the Askja-S tephra and (iii) the sedimentological response of the JC record to the Preboreal Oscillation (PBO), a short lived cold episode during the early Holocene.

A differential dating approach revealed a time span of $152 +11/-8$ varve years counted in the JC sediment record between both tephras. Since the varved interval of the JC sediment record comprising the tephras is floating, we anchored the floating varve chronology to an absolute timescale by using the radiocarbon-dated Hässeldalen Tephra ($11,380 \pm 216$ cal a BP, Wohlfarth et al, 2006). The resulting age for the Askja-S of $11,454-11,002$ cal a BP is, even considering the rather large uncertainties, a few decades to several hundred years older than most radiocarbon based age models, but it supports the original age model from Hässeldala port. The sediment response to the PBO cold period is seen only in a slight decrease in titanium, a proxy for detrital matter flux. Varve micro-facies did not change during this interval confirming a weak impact of the PBO on the sedimentation regime in Lake Czechowskie.

This study is a contribution to the Virtual Institute of Integrated Climate and Landscape Evolution Analyses – ICLEA – of the Helmholtz Association, grant number VH-VI-415.

Wohlfarth, B., Blaauw, M., Davies, S.M., Andersson, M., Wastegård, S., Hormes, A., Possnert, G., 2006. Constraining the age of Lateglacial and early Holocene pollen zones and tephra horizons in southern Sweden with Bayesian probability methods. *J. Quat. Sci.* 21, 321–334. doi:10.1002/jqs.996