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Chironomid oxygen isotope record of mid- to late Holocene climate evolution from southern Spitsbergen

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The oxygen isotope composition of head capsule chitin of chironomid larvae picked from a sediment core covering the past 5500 years from lake Svartvatnet in southern Spitsbergen was used to reconstruct the isotopic composition of oxygen in lake water ($\delta^{18}O_{lw}$) and local precipitation. Consistent with the gradual cooling of climate over the Neoglacial period, the $\delta^{18}O_{lw}$ record displays a gentle decreasing trend over the study period. The Svartvatnet $\delta^{18}O_{lw}$record shows a maximum at ca. 1900-1800 cal BP, consistent with the timing of the Roman Warm Period, and three negative excursions increasing in intensity towards the present-day at 3400-3200, 1250-1100 and 350-50 cal BP, which are tentatively linked to multidecadal periods of low solar activity amplified by oceanic and atmospheric feedbacks. The time period of the Little Ice Age shows a two-step decrease in $\delta^{18}O_{lw}$values, with a remarkable, 8-9‰ drop at 350-50 cal BP construed to predominantly represent significantly decreased winter temperatures during a period of increased seasonal differences and extended sea ice cover inducing changes in moisture source regions. Similarity of the trends between the $\delta^{18}O_{lw}$record and a July-T reconstruction based on chironomid assemblages (Luoto et al., in review) from the same core suggests that air temperature exerts a significant control over the $\delta^{18}O_{lw}$values, but the record is most likely influenced by changes in sea ice extent and possibly the seasonal distribution of precipitation.

Reference: Luoto TP, Ojala A, Brooks S et al. Synchronized proxy-based temperature reconstructions reveal mid-to late Holocene climate oscillations in High Arctic Svalbard. *Journal of Quaternary Science*, submitted.