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Changes in temperature and water depth of a small mountain lake during the past 3000 years in Central Kamchatka reflected by a chironomid record



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ABSTRACT

We investigated chironomid assemblages of a well-dated sediment core from a small seepage lake situated at the eastern slope of the Central Kamchatka Mountain Chain, Far East Russia. The chironomid fauna of the investigated Sigrid Lake is dominated by littoral taxa that are sensitive to fluctuations of the water level. Two groups of taxa interchangeably dominate the record responding to the changes in the lake environment during the past 2800 years. The first group of littoral phytophilic taxa includes *Psectrocladius sordidellus*-type, *Corynoneura arctica*-type and *Dicretodipes nervosus*-type. The abundances of the taxa from this group have the strongest influence on the variations of PCA 1, and these taxa mostly correspond to low water levels, moderate temperatures and slightly acidified conditions. The second group of taxa includes *Microtendipes pedellus*-type, *Tanytarsus lugens*-type, and *Tanytarsus pallidicornis*-type. The variations in the abundances of these taxa, and especially of *M. pedellus*-type, are in accordance with PCA 2 and correspond to the higher water level in the lake, more oligotrophic and neutral pH conditions. Water depths (WD) were reconstructed, using a modern chironomid-based temperature and water depth calibration data set (training set) and inference model from East Siberia (Nazarova et al., 2011). Mean July air temperatures (T July) were inferred using a chironomid-based temperature inference model based on a modern calibration data set for the Far East (Nazarova et al., 2015). The application of transfer functions resulted in reconstructed T July fluctuations of approximately 3 °C over the last 2800 years. Low temperatures (11.0–12.0 °C) were reconstructed for the periods between ca 1700 and 1500 cal yr BP (corresponding to the Kofun cold stage) and between ca 1200 and 150 cal yr BP (partly corresponding to the Little Ice Age [LIA]). Warm periods (modern T July or higher) were reconstructed for the periods between ca 2700 and 1800 cal yr BP, 1500 and 1300 cal yr BP and after 150 cal yr BP. WD reconstruction revealed that the lake level was lower than its present level at the beginning of the record between ca 2600 and 2300 cal yr BP and ca 550 cal yr BP. Between ca 2300 and 700 cal yr BP as well as between 450 and 150 cal yr BP, the lake level was higher than it is today, most probably reflecting more humid conditions.

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1. Introduction

The extremely scarcely populated Kamchatka and the Kuril Islands (Far East Russia) remain among the least studied regions on the Earth. These regions contain many wilderness areas where there has been little human impact, making them invaluable to the