Global and Planetary Change 134 (2015) 101–117

Contents lists available at ScienceDirect

Global and Planetary Change

journal homepage: www.elsevier.com/locate/gloplacha

Holocene environment of Central Kamchatka, Russia: Implications from a multi-proxy record of Two-Yurts Lake

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ARTICLE INFO

Article history:
Received 11 November 2014
Received in revised form 22 July 2015
Accepted 29 July 2015
Available online 16 August 2015

Keywords:
Kamchatka
North Pacific
Holocene Climate
Palaeolimnology
Diatoms
Pollen

ABSTRACT

Within the scope of Russian–German palaeoenvironmental research, Two-Yurts Lake (TYL, Dvuh-Yurtochnoe in Russian) was chosen as the main scientific target area to decipher Holocene climate variability on Kamchatka. The 5 × 2 km large and 26 m deep lake is of proglacial origin and situated on the eastern flank of Sredinny Ridge at the northwestern end of the Central Kamchatka Valley, outside the direct influence of active volcanism. Here, we present results of a multi-proxy study on sediment cores, spanning about the last 7000 years. The general tenor of the TYL record is an increase in continentality and winter snow cover in conjunction with a decrease in temperature, humidity, and biological productivity after 5000–4500 cal yrs BP, inferred from pollen and diatom data and the isotopic composition of organic carbon. The TYL proxy data also show that the late Holocene was punctuated by two colder spells, roughly between 4500 and 3500 cal yrs BP and between 1000 and 200 cal yrs BP, as local expressions of the Neoglacial and Little Ice Age, respectively. These environmental changes can be regarded as direct and indirect responses to climate change, as also demonstrated by other records in the regional terrestrial and marine realm. Long-term climate deterioration was driven by decreasing insolation, while the short-term climate excursions are best explained by local climatic processes. The latter affect the configuration of atmospheric pressure systems that control the sources as well as the temperature and moisture of air masses reaching Kamchatka.

1. Introduction

Within the scope of Russian–German palaeoenvironmental research, Two-Yurts Lake (TYL, Dvuh-Yurtochnoe in Russian) was chosen as the main scientific target area to decipher Holocene climate variability on the Kamchatka peninsula, an area so far underrepresented in palaeoclimatic research (see Brooks et al., 2015-in this volume). Despite intense palaeoclimatic research of Holocene climate variability over the last decades, the spatial coverage of studied climate records is patchy in the mid- to high latitudes of northeastern Asia (Kaufman et al., 2004; Mayewski et al., 2004; Wanner et al., 2008; Biskaborn et al., 2012; Sundqvist et al., 2014). The main motivation for palaeoenvironmental research on Kamchatka arises from the following considerations: The study area represents an important climate-sensitive region within the global climate system. The maritime-influenced region is situated at the border of the Eurasian landmass and the North Pacific, and as such offers the potential to pinpoint connections of environmental changes between landmass and ocean in the north-west Pacific realm. It is situated at the eastern end-loop of the global thermohaline ocean conveyor belt and is strongly affected by atmospheric teleconnections, oceanographic, cryospheric, tectonic, and volcanic processes in the Arctic and sub-Arctic Pacific regions and neighboring landmasses of north-eastern Eurasia (Saenko et al., 2004; Krinner et al., 2011; Melles et al., 2012; Bauch, 2012; Dirksen et al., 2013; Brooks et al., 2015-in this volume). Since the area is extremely scarcely populated, Kamchatka remains among the least studied regions on Earth. Many areas of wilderness, that have little impact by humans make Kamchatka a valuable place for the study of palaeoenvironmental changes under natural climate variability (Dirksen et al., 2013).

Starting in the 18th century, early explorers were mainly attracted to this remote regions by the frequent volcanic eruptions and a rather specific flora and fauna (Krasheninnikov, 1755). Despite a long research

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http://dx.doi.org/10.1016/j.gloplacha.2015.07.011
0921-8181/