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Quantitative reconstructions of mid- to late holocene climate and vegetation in the north-eastern altai mountains recorded in lake teletskoye

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ABSTRACT

We report the first high-resolution (20–50 years) mid- to late Holocene pollen records from Lake Teletskoye, the largest lake in the Altai Mountains, in south-eastern West Siberia. Generally, the mid- to late Holocene (the last 4250 years) vegetation of the north-eastern Altai, as recorded in two studied sediment cores, is characterised by Siberian pine–spruce–fir forests that are similar to those of the present day. A relatively cool and dry interval with July temperatures lower than those of today occurred between 3.9 and 3.6 ka BP. The widespread distribution of open, steppe-like communities with *Artemisia*, Chenopodiaceae and Cyperaceae reflects maximum deforestation during this interval. After ca. 3.5 ka BP, the coniferous mountain taiga spread significantly, with maximum woody coverage and taiga biome scores between ca. 2.7 and 1.6 ka BP. This coincides well with the highest July temperature (approximately 1 °C higher than today) intervals. A short period of cooling about 1.3–1.4 ka BP could have been triggered by the increased volcanic activity recorded across the Northern Hemisphere. A new period of cooling started around 1100–1150 CE, with the minimum July temperatures occurring between 1450 and 1800 CE.

1. Introduction

The Altai Mountains provide an important connection between the Central Asian steppe and the North Asian forest-steppe. Holocene environmental changes might have had a significant influence on the development of human societies in this region. Many well-known archaeological sites from the Paleolithic to the Middle Ages, such as Denisova Cave, the Pazyryk necropolis, and the Ukok tombs, are situated in the Altai Mountains (Polosmak, 2001; Derevianko et al., 2003). The Altai, which is shared by China, Kazakhstan, Mongolia and Russia is a prominent sub-longitudinal mountain range of Central Asia that extends approximately 1200 km in a north–south direction and rises up to 4500 m a.s.l. (Atlas of geological maps of Central Asia and adjacent areas, 2008). It is an important climatic and natural boundary at the limits of both Pacific and Atlantic influences and a divide between Boreal and Ancient Mediterranean floristic sub-kingdoms of the Holarctic (Takhtajan, 1986). The Altai Mountains also contain relic vegetation types and paleoenvironmental studies can shed light on the vegetation history of the region. This is important, because a sizeable part of the Altai, including Lake Teletskoye, is a UNESCO World Heritage site, named the "Golden Mountains of Altai" (http://whc.unesco.org/en/list/).

Pollen records represent one of the most powerful tools to understand past environmental changes. Several Holocene pollen records from the Altai Mountains with varying time resolutions have been

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