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Late Quaternary history of cold-deciduous (larch) forest in eastern Siberia based on pollen data

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Recently published botanical records from high-latitude regions of Europe and North America indicate that boreal forests established during the Holocene interglacial (the past 11.6 ka) as a result of expansion of tree populations from southern glacial refugia and local spreading of small tree populations that survived the Last Glacial Maximum interval (LGM: 25-17 ka) in so called cryptic refugia. An extensive dataset of radiocarbon-dated macrofossils from northern Asia provides evidence that boreal trees advanced close to the current arctic coastline between 9 and 7 ka. However, until recently (Tarasov et al., 2009; Werner et al., 2010) wood macrofossils older than 10 ka were not reported from the large region of eastern Siberia between 108° and 145°E, rising discussions on whether trees could persist there during the coldest phases of the last glacial period. Lately published pollen data from the Verkhoyansk Mountains (e.g. Müller et al., 2009; 2010; Tarasov et al., 2009) show the predominance of herbaceous (tundra and steppe) communities in the low-elevated western part, about 140 km south of the Arctic Circle throughout the full-glacial and late-glacial interval since ca. 50 ka BP. Highest values of Cyperaceae, Poaceae and Artemisia pollen attest that the whole interval between 31 and 13.5 ka BP was the driest and coldest interval of the entire record. Nevertheless, quasi-continuous presence of Larix pollen and pollen of dwarf birch, shrub alder, and other woody taxa, throughout the last 50.7 ka suggests at least rudimental presence of the cold deciduous forest taxa in the region. We conclude that the western macro-slope of the Verkhoyansk Mountains, with its numerous lakes and river valleys could have provided enough moisture and warm microhabitats buffering larch trees against climatic extremes even during substantially colder and drier than present intervals, including the YD and possibly LGM. The presence of small but numerous larch populations during the late glacial and YD likely explains the quick reforestation of eastern and northern parts of Siberia already by the early Holocene and supports the DNA-based hypothesis suggesting the existence of high-latitude boreal plant refugia during past glaciations.