Holocene Vegetation History of the Verkhoyansk Mountains Foreland, Northeastern Siberia

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Study Site

Fig. 1 Outcrop at the northern slope of the River Dyanushka, Central Yakutia

Fig. 2 Peat profile at the northern slope of the River Dyanushka, northeastern Siberia

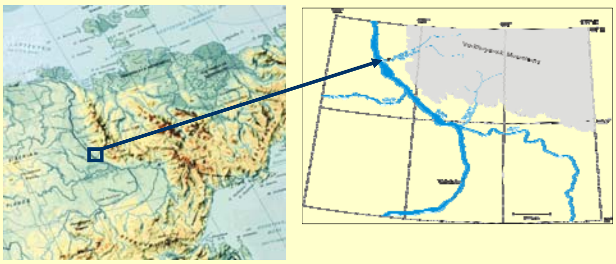


Fig. 3 Maps of northeastern Siberia/Central Yakutia

A peat profile from the western foreland of the Verkhoyansk Mountains, Central Yakutia (Fig. 1) provides a new high-resolution record of the Holocene vegetation and summer climate history in northeastern Siberia.

The radiocarbon dated peat sequence (65°02'N, 125°02'E) is situated at the northern slope of Dyanushka River, an eastern tributary to Lower Lena River (Fig. 1-3). The section lithology (Fig. 2) indicates that underlying frozen peat layers are overlain by silty and sandy Late Holocene/recent sediments.

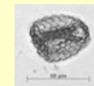
Different proxies were used to reconstruct past environmental conditions (pollen, macrofossils, non-pollen-palynomorphs, Fig. 4, 5). Macrofossils such as *Larix dahurica* needles and cones, and *Sphagnum* moss tissues were picked for radiocarbon dating.

Non-pollen-palynomorphs (NPPs)

Oocyte of *Neorhabdocoela* (small soft-bodied flatforms belonging to the microturbellarians) (Haas, J.H., 1996; pers. communication)

Bryozoan statoblast, a cyst of Bryozoa (underwater or moss colonies) (Finn Viehberg, pers. communication)

Remains of Pinaceae wood with stomates



Egg from an unknown species of water bear (Tardigrada)

Fig. 4 Non-Pollen-Palynomorphs: Microfossils of various origin are also preserved in the pollen samples due to insufficient oxidation in peat

Macrofossils

Needles of *Larix dahurica*

Seed of *Larix dahurica*

Head of beetle *Donacia sp.*

Seed of *Betula platyphylla cf.*

Seed of *Carex sp.*

Seed of *Menyanthes trifoliata*

Fig. 5 Plant macrofossils are an excellent tool to complete pollen records. A few samples were analysed for plant macrofossils and zoological remains mainly for dating purposes

Results

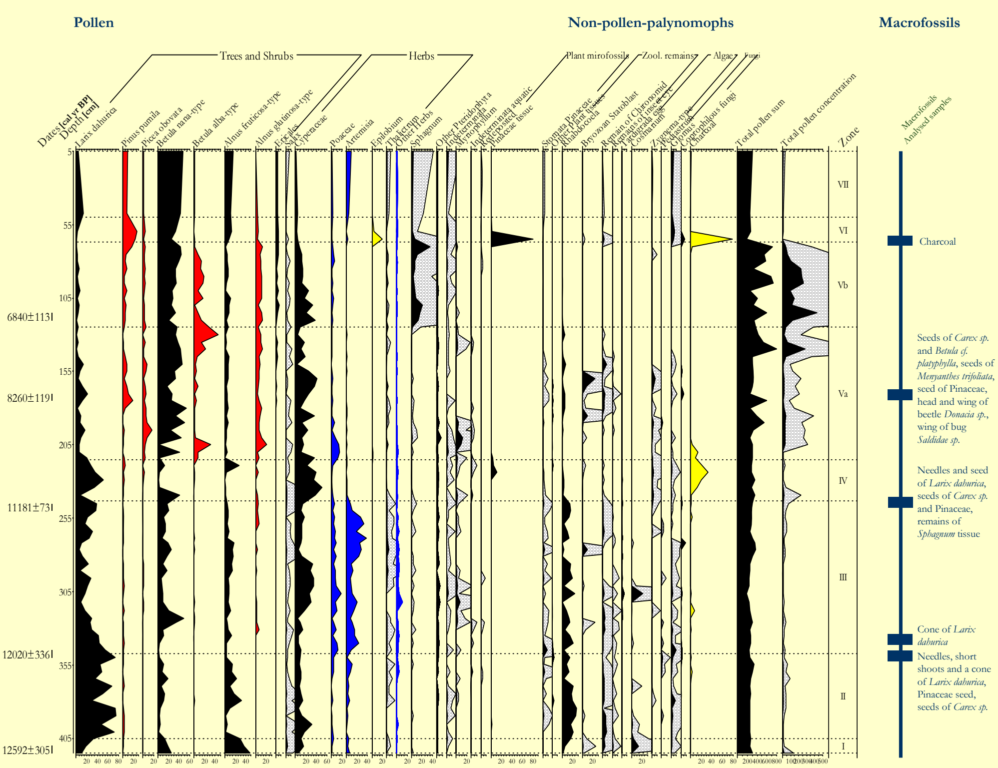


Fig. 6 Diagram with radiocarbon dates and record of pollen, NPPs and macrofossils (shaded area: exaggeration 10:1, red: indicator for warm climate, blue: indicator for cool climate, yellow: possible fire event)

Interpretation

Zones

VII **Modern Vegetation** The uppermost sediments reflect modern larch forest with few other trees (***Betula pendula***, ***Picea obovata***) and shrubs (***Alnus fruticosa, Pinus pumila, Betula nana***).

VI **Fire event** High amounts of charcoal and burned objects as well as ***Epilobium*** pollen indicate a fire event that destroyed local vegetation.

Vb **Warm climate conditions** ***Betula*** **sect.** ***Albae***, ***Alnus glutinosa, Pinus,*** **and** ***Picea*** **pollen reflect the relatively warm climate conditions. The transition from lacustrine oxbow environment to a mire is supported by the dramatic increase of** ***Sphagnum*** **spores and peaks in Cyperaceae pollen. Microfossils of terrestrial and swampy habitats (*Glomus*, coprophilous fungi) predominate.**

Va **Peatland development** **Warm indicator taxa (red marked in the pollen record) such as** ***Pinus pumila***, ***Picea, Betula*** **sect.** ***Albae***, **and** ***Alnus glutinosa*** **point to climate amelioration. Seeds of** ***Menyanthes trifoliata*** **as well as remains of the beetle** ***Donacia sp.*** **and the bug** ***Saldidae sp.*** **indicate lacustrine and lake shore environment. This is also supported by numerous** ***Sphagnum*** **moss remains and** ***Sphagnum*** **spores.**

IV **Warm and wet climate** ***Larix*** **and Cyperaceae pollen increases indicate a wet and warm climate. Oocytes of** ***Neorhabdocoela***, **Bryozoan statoblasts indicating shallow lake environment (Peteet, D., 1998) or cysts of algae point to locally lacustrine conditions.**

III **Cool stage** **The dominance of herbs (blue marked in the pollen record) indicates treeless vegetation and drier climate conditions. However, spores of** ***Equisetum*** **and pollen of** ***Myriophyllum*** **point to a locally moister environment. Seeds of** ***Carex sp.*** **are in a good agreement with the dominance of Cyperaceae pollen in the record.**

II **Postglacial climate amelioration** **This zone displays first appearance of** ***Picea obovata*** **pollen. Large amount of** ***Larix*** **pollen points to relatively favourable conditions for larch.**

I **Cool and dry climate conditions** **This zone is notable for its large amounts of** ***Betula*** **sect.** ***Nanae*** **and** ***Alnus fruticosa*** **pollen indicating relatively cool and dry conditions.**

Conclusions

The presented data provide a high resolution record of the Holocene vegetation and climate changes in Central Yakutia, northeast Siberia. Early vegetation of herb and shrubs indicating relatively cool and dry conditions possibly evidence the Younger Dryas cooling. A climate optimum after 10 cal kyr BP is in good agreement with other pollen records in northeast Siberia (Anderson et al., 2002; Pisaric et al., 2001).

The onset of peat formation between 11.5 and 9 cal kyr BP at the Dyanushka site is consistent with the increased peatland expansion in western Siberia (Smith et al., 2004). It is assumed that postglacial peatland formation in Siberia markedly contributed to the global increase of atmospheric methane concentration during the Early Holocene. Future work should seek for the role of peatlands in Eastern Siberia.

References

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