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Ancient plant DNA, macro- and microfossil studies of the lake sediments from the High Arctic lake Tenndammen, Svalbard

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Ancient DNA metabarcoding applied together with the investigations of the plant macro-remains, pollen, spores and non-pollen palynomorphs (NPP), open new perspectives and give better taxonomical resolution, allowing to obtain more precise and specific data on the local environment conditions and their changes. So far, only three multiproxy studies that involve both molecular and palaeobotanical/palynological methods are available for the high Arctic archipelago Svalbard. We intend to contribute filling this gap. Therefore, a field trip to Svalbard was undertaken in September, 2019, and three sediment cores were retrieved from the Tenndammen lake (N 78°06.118; E 15°02.024, 7 m asl) which is a small and shallow water body (ca 2.5 m depth). The lake is located in the valley of Colesdalen, a well-known Svalbard's biodiversity hot spots and a home for about seven to ten thermophilic plant species.

To investigate the Holocene to modern vegetation history of this place, the 85cm core Te2019 was chosen, it was described for lithology, X-rayed, µXRF-scanned, line-scan photographed with high resolution and sampled for sedaDNA, pollen, spores and NPP studies as well as for studies on plant macrofossils. Ten 14C AMS dates were taken in order to establish an age-depth model. The DNA record contains around 100 taxa, most findings of those are supported by pollen studies (Asteraceae, Betula, Brassicaceae, Salix, Saxifraga, Vaccinium/Ericaceae) and by spores (Equisetum and Bryophyta). In addition, various fungi spores were identified. Investigations of plant macro-remains well support findings of the aquatic (i.e. Warnstorfia fluitans) and terrestrial mosses (e.g. Aulacomnium conf. turgidum, Bryum spp., Distichium capillaceum, Calliergon richardsonii, Scorpidium cossonii, Sphagnum spp., Rhizomnium spp.). Besides, fragments of Salix and Betula leaves and fruit parts, various leaf, stem tissues and flower fragments of Saxifraga species were found within the samples from the same depths with the correspondence to DNA records. Three DNA zones (SvDNA 1 – SvDNA3) and one subzone within the earliest zone (SvDNA-1a – SvDNA-1b) were established. Relations between DNA, pollen and macrofossil zones were studied. This study is performed within the "Future ArcTic Ecosystems" (FATE) research program: Initiative for investigation on drivers of diversity and future scenarios from ethnoecology, contemporary ecology and ancient DNA.