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Late Holocene development of ice-edge polygon terrain in Adventalen valley (Svalbard) based on sedimentological evidences

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During the field work campaigns of summer 2010 and 2011 we have studied the sedimentological features in two areas in Adventalen valley (Svalbard) where ice-wedge polygons are present. These areas correspond to: (1) a glacio-fluvial terrace on the northern bank of the Advent river, and (2) the lowest part of the Todalen alluvial fan, in the southern bank of the Advent river.
With the purpose of understanding the role of the soils and sediments in the formation and development of ice-wedge networks, tens of pits and sections were opened in order to examine the sedimentary record in these areas. The thickness of the active layer at the end of summer (50-110 cm) determined the depth down to which sections were examined. Moreover, in the cliffs of the Advent river we excavated exposures up to 2 m depth to better analyze the sedimentary sequence. Samples were collected from the different lithostratigraphic units for standard laboratory analyses (grain size, organic matter content, XRF). Ten AMS C14 dates allow establishing the chronological framework of the environmental evolution inferred from the key sections.
Field work and laboratory data points to significant landscape changes in the area over the Late Holocene. The peat layer detected in the basal layer of the northern section is found widespread across the valley and it has been dated back to 3.8-3.3 ka BP, which is consistent with other radiocarbon dates existing in the valley. The alternation of organic-rich layers and aeolian layers existing in the upper part of the section developed during the Late Holocene. A more intense wind deposition is likely to have occurred in the southern bank of the river, where the peat layer has not been found in the upper 2 m thick exposure. This section is more homogeneous, with silty-sandy aeolian units alternating with organic silty layers in the bottom of the section.
In conclusion, sedimentological data has provided a better understanding of the environmental conditions (and climate) more favorable for the development of ice-wedge polygons in this arid Arctic environment during the Late Holocene.