News from the Klondike Goldfields (Canada) - first results of the AWI expedition Klondike 2023

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Introduction

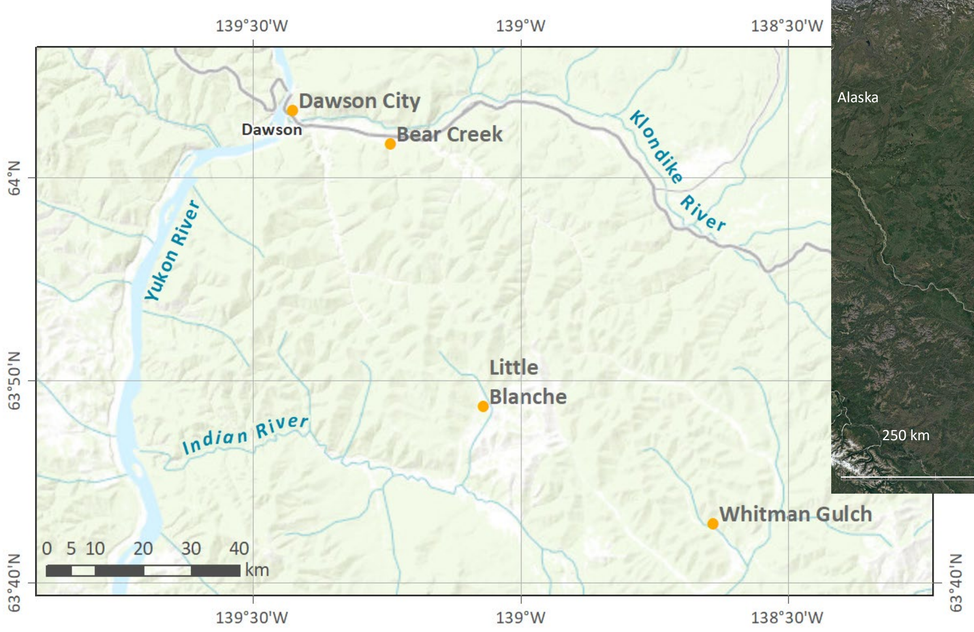
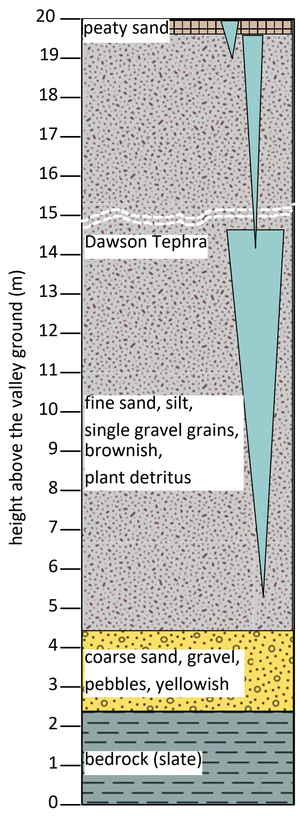


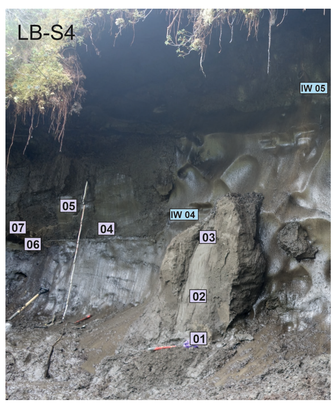
Fig. 1 Study area of the Klondike Goldfields in the Canadian Yukon Territory and the study sites (Bear Creek, Little Blanche, Whitman Gulch)

Over the last 25 years, Canadian scientists have studied the **permafrost environmental archives** in the Klondike Goldfields south of Dawson City. In 2023, a small Canadian-German team visited this area to sample mining exposures in the Klondike area (Fig.1). The goal was to conduct studies on ground ice (ice wedges and pore ice) and frozen sediments to reconstruct past landscape and climate conditions. Detailed profiles were sampled at three sites Little Blanche Creek, Whitman Gulch, and Bear Creek (Fig. 1).

Gold mining began in the late 19th century and continues today.

Fieldwork





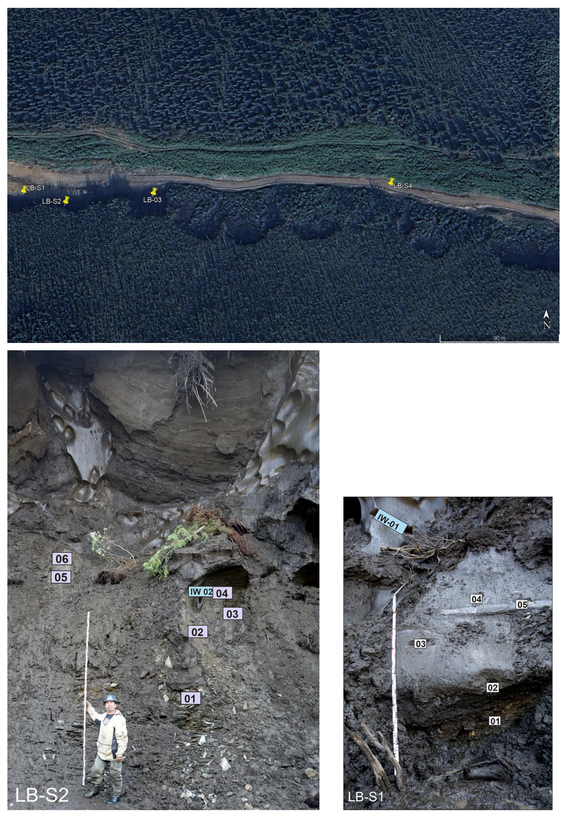
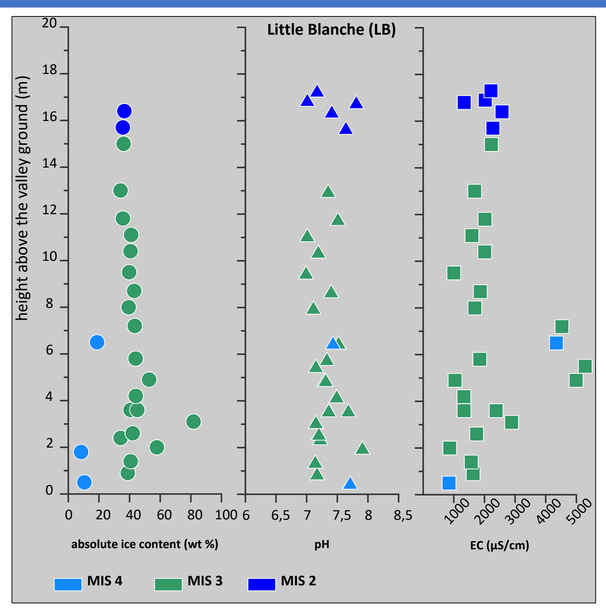


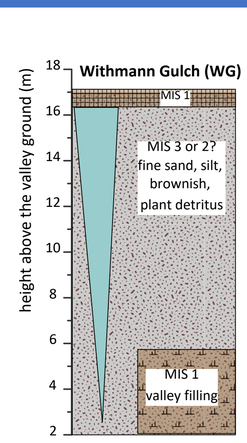
Fig. 2 Field studies in the Little Blanche (LB) Valley and a schematic profile

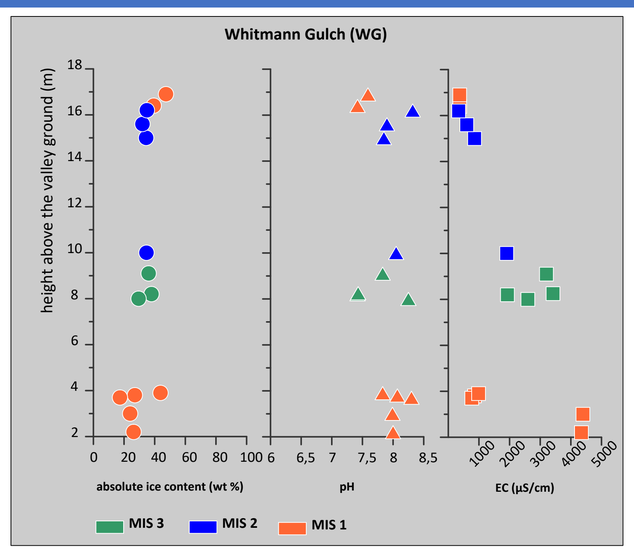
For gold mining, ice-rich permafrost overlying gold-bearing gravel is thawed with water cannons and removed with excavators. This gives the short-term opportunity to examine fresh permafrost walls. Ice wedges were described in terms of their size, the color of ice, internal structure, existence and form of gas bubbles and were sampled by chain saw as blocks. The frozen sediment was cleaned, and ice and sediment structures were described, followed by sediment sampling with axe and hammer.

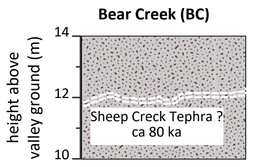
The Dawson tephra ejected by Aleutian volcanoes about 30,000 years ago and spread widely across Alaska and northwestern Canada, served as Quaternary stratigraphic orientation.

First analytical results









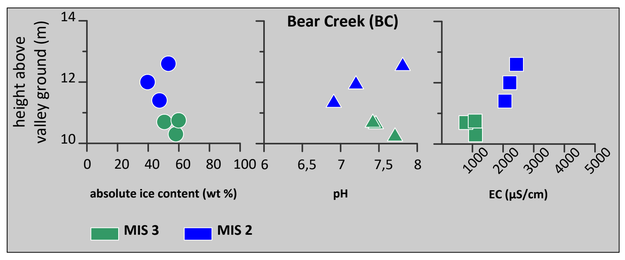


Fig. 3 First analytical results of the Little Blanche (LB), Whitman Gulch (WG), and Bear Creek (BC) profiles

Up to now, the absolute ice content (measured already in the field), pH value, and electrical conductivity (EC) of the pore ice have been determined (Fig. 3).

Determination of cation and anion contents, stable water isotopes of pore ice, and sediment investigations of grain-size parameters, TOC, TC, TN, and $\delta^{13}C$ are still in progress. Geochronological investigations (^{14}C, optically stimulated luminescence) and tephra geochemistry are planned for spring 2024.

Data in a nutshell

- *Ice content: LB 42,6 wt% (8-81wt%), BC 51,5 wt% (40-60 wt%), WG 33,2 wt% (17-47 wt%)*
- *Electrical conductivity: LB 2183 µS/cm (1000-2574 µS/cm), BC 1615 µS/cm (786-2437 µS/cm), WG 1796 µS/cm (338-4493 µS/cm),*
- *pH: LB 7,3 (7,0-7,8), BC 7,4 (6,9-7,8), WG 7,9 (7,4-8,3)*

Conclusions

- Ice content, electrical conductivity, and pH values in the Klondike profiles are in **similar ranges like from Yedoma** deposits and related profiles in **Alaska and Northeast Siberia**
- There are so far no clear stratigraphic differences in the previous analyses of the three sites.
- Stable-isotope analyses of ice wedges from the three study sites, as well as additional sediment analyses, will further advance the **reconstruction of late Quaternary environmental conditions** in the Central Yukon.