



## **Thaw lakes in the geological record and their significance for Pleistocene glacial methane emissions**

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Thaw (or thermokarst) lakes are striking features of present-day arctic lowlands underlain by permafrost, covering 20-50% of the land surface in some cases. Evidence from the geological record shows that during the last glacial thaw lakes also occurred in lowlands within the periglacial zone in Europe. Thaw lakes are found in river valley fills, in glacial and tectonic basins. Thaw lakes in the sedimentary record are characterized by a succession of features indicating the former presence of permafrost (ice wedge casts), followed by permafrost degradation features (generally large cryoturbations), in turn overlain by lacustrine deposits. These successions have been reported from several sites in the Netherlands and Northern Germany. Stratigraphic information suggest that these lakes were of widespread occurrence, and may have resulted from repeated changes in the southern permafrost boundary during rapid climate shifts of the last glacial.

CH<sub>4</sub> emission from thaw lakes in Siberia and Alaska contributes significantly to CH<sub>4</sub> emission from northern wetlands. Likewise, also ancient thaw lakes may have contributed to the CH<sub>4</sub> emission that led to the CH<sub>4</sub> spikes recorded in the ice cores during the last glacial. For an estimation of glacial CH<sub>4</sub> sources, the strength of the thaw lake source needs to be quantified.