

Permafrost degradation and thermokarst dynamics in the Alaskan and western Canadian Arctic

The ecosystems of high-latitude regions have experienced dramatic climatic and ecological changes since the last glaciation. These changes are reflected in the state of permafrost, which formed (for most of it) under cold climatic conditions, but is now experiencing an increase of air temperatures that drastically alters its thermal, geotechnical, and hydrological properties. When ice-rich permafrost thaws for instance, the ice contained in the ground eventually melts and leads to thaw subsidence which can profoundly change the landscape water regime. Thermokarst lakes are a widespread feature of the western North American Arctic and result from such changes. Their morphology, the characteristics of their catchments and the sediments and fossil bioindicators accumulated in their basins are great integrators of their surrounding environment and can help to explain their genesis but also the past development of the landscape.

In this study new lake sediment archives from Alaska and the Canadian Yukon Coastal Plain will be recovered to reconstruct the past environment in the vicinity of a former glaciated area. A multidisciplinary research approach will be applied using geochronological, sedimentological, biogeochemical, isotope geochemical, paleoecological and hydrochemical methods.

The doctoral project will be undertaken at the Alfred-Wegener-Institute for Polar and Marine Research (Research Unit Potsdam) and is funded with a PhD scholarship of the University of Potsdam. A stipend awarded by the Association for Canadian Studies in German Speaking countries as well as a cooperation with McGill University in Montréal and the University of Alaska Fairbanks are instrumental in making this study possible.

Colleagues from the University of Alaska Fairbanks provide lake sediment cores from Alaska previously recovered so that the laboratory work can start immediately with the begin of the doctoral project in October 2011. Two expeditions will help to get additional lake sediment material from the Canadian Arctic. In summer 2012, pre-investigations of a thermokarst lake on the Yukon Coastal Plain will be carried out together with colleagues of the Alfred-Wegener-Institute for Polar and Marine Research, the University of Bonn and McGill University in Montréal. During this expedition, geophysical methods will be used to map the morphology of the thermokarst depression and the depth of the unfrozen zone underneath the lake (Talík). Additionally, a biological inventory and a study of the hydrochemical conditions of the modern lake will be performed through the analyses of water samples. In Spring 2013, a long sediment record from the thermokarst lake on the Yukon Coastal Plain will be recovered by drilling from the lake ice surface. This lake record will complete our transect of paleoenvironmental archives. This palette of records will provide a thorough understanding the evolution of the environment of the past in the area and will form a

benchmark for the study and the prediction of modern and future landscape processes in the western Canadian and Alaskan Arctic. This, in turn, will inform adaptation and mitigation strategies for the area in the 21st century.