The global climate change results in world-wide shrinkage of glaciers and freshly deglaciated landscapes undergo complex adjustment to non-glacial conditions. Subaerial weathering of rock surfaces within glacial forelands developed since 19^{th} c. (Little Ice Age or LIA) glacial maxima are at the forefront of such changes. However, there are only few studies focusing on differences in rock surface deterioration within contemporary glacial forelands.

Field studies will be carried out in the Midtre Lovénbreen (Svalbard), and in the Hallstaetter Glacier foreland (Salzburger Alps). The first foreland contains local Proterozoic metamorphic and Carboniferous sedimentary rocks while Hallstaetter Glacier foreland is developed in fine-grained Upper Triassic limestone. The rate of recession of the glaciers and the age of the outermost LIA moraines are known. This will allow to infer about the rate of rock surface deterioration and weathering alteration of minerals.

Following research questions are put forward: 1) What is the rate of rock surface decay (development of weathering microrelief, weathering rind, rock surface weakening, surface mineral alteration) in High-Arctic and temperate Alpine proglacial environments of various petrography? 2) Can mineral alterations of rock surfaces resulting from weathering since the end of LIA be registered in radiation spectra? Can spectral signatures be used in relative dating of glacial landforms.

Following hypotheses are put forward: 1) There is a significant rate of rock surface decay (visible in a dozen or so years after deglaciation), manifested by a rapid development of surface micro-roughness, weathering rind, rock surface weakening and chemical alteration of minerals on the rock surface. 2) Mineral alterations of rock surfaces resulting from weathering since the end of LIA can be registered in infrared radiation. Spectral signatures can be used in relative dating of glacial landforms.

In each of the forelands five test polygons will be designed along transects running form the youngest rock surfaces (near the glacier margin) to the oldest (at LIA glacial maximum). The polygons will be located on bedrock or boulders embedded in the moraines with distinct traces of glacial abrasion, allowing to infer that older weathering rind (developed before glacial accumulation) has been completely eroded. Micro-roughness will be measured with a use of an electronic profilometer and Schmidt hammer (SH) tests will provide information of rock surface hardness. On the rock surfaces previously checked for micro roughness and SH rebound, spectral measurements will be performed using a spectroradiometer (visible and infrared wavelengths). Next, the weathering rinds including underlying rock will be chipped-off in order to determine the color and thickness of the rind and collect samples for microscopic analyses. Photogrammetric surveys based on the unmanned aerial vehicle will provide high-resolution images which will be used to provide high accuracy orthophoto maps and Digital Elevation Models. Identification of landform assemblages will help in determination of a topographic characteristics and age of rock surfaces used for detailed weathering studies (test polygons) and type of deglaciation.

Collected rock samples will be used to determine petrography, mineral composition and porosity of weathering rinds as well as possible coatings and interior of rocks by optical microscope in passing light. The chemical composition of the samples will be analyzed using a scanning electron microscope. A statistical analysis of the spectral characteristics of minerals composing studied rocks will be carried out and statistically significant differences in the spectrum range between the type of minerals and their location will also be checked.

Finally, all data on rock types, weathering micro-relief, rock strength, weathering rinds (tested statistically), and landform settings will be correlated with results of the spectral measurements in order to verify hypothesis put forward.