Erosion of coastal cliffs poses risk to houses, historical structures and roads. Cliff failure may accelerate as a result of observed and further predicted sea level rise and intensified storminess. Understanding the rates of cliff retreat, dominant mechanisms (landsliding, rockfall, crumbling of weathered material, etc.) and controls on erosion is crucial for predicting future change and improving coastal management.

Scientific investigation of the Baltic coastal cliffs focuses on weak bluffs composed of glacial deposits in northern Poland and Germany, as well as on soft chalk cliffs of German and Danish islands. Literature concerning cliffs built in Paleozoic sedimentary rocks (limestone, sandstone) is scarce, which is surprising given the proximity of residential areas, tourist attractions and roads, and documented large rock failure events. We do not know how the decreasing sea ice cover and the increasing air temperatures (control on freeze/thaw cycles) impact cliff erosion.

This project focuses on seven morphologically, geologically and environmentally diverse cliffs located in Estonia, Sweden and Latvia. By applying a range of scientific methods including fieldwork, GIS analyses, cosmogenic dating and numerical modelling we aim to approach erosion of investigated coasts in a comprehensive multi-scale fashion. Terrestrial Laser Scanning and drone photography combined with Structure-from-Motion photogrammetry will be used to measure cliff retreat rates at short timescale (years). Historical data (maps, aerial photographs, documents) will be the basis for measuring decadal-scale cliff top retreat. Finally, exposure dating using cosmogenic radionuclides will allow the reconstruction of long-term (millennia) cliff retreat rates. We will use statistical analyses to describe spatio-temporal patterns of erosion and to identify relationships between cliff erosion, coastal morphology, geology and environmental factors (sea level change, wave energy, meteorological conditions, sea ice extent).

Study results will provide a better understanding of the dynamics of the Baltic coastal cliffs built in Paleozoic rocks in the past and at present, as well as a prediction of future change depending on the scenarios of climate change (sea level rise, intensified storminess, air temperature rise, sea ice decline, etc.).