Description for the general public (in English)

The Scandinavian Caledonides represent a collisional orogen of Himalayan-Alpine dimensions that has formed as a result of collision of two continents, Laurentia (North America and Greenland) and Baltica (Northern Europe) during closure of the Iapetus Ocean in the Ordovician and Silurian. The orogen is characterized by a series of terranes that have been emplaced onto the Baltican margin after long-distance eastward transport of hundreds of kilometers. In the Caledonides, these terranes are devided into Lower, Middle, Upper, and Uppermost Allochthons and they occur as orogen-parallel belts. The crystalline basement is exposed in a number of tectonic windows across the orogen and the largest one is represented by the Western Gneiss Region in Norway.

During recent years, much effort has been put into research on the processes that act during the exhumation of deeply subducted ultra-high pressure metamorphic complexes in the Caledonides, and on the emplacement of high-grade metamorphic allochthons. In this project we aim (1) to derive the comprehensive temperature-time (T-t) paths for the high- and ultra-high pressure (HP-UHP) rocks of the Middle Allochthon from the Swedish part of the Scandinavian Caledonides; and (2) to define the character and age of the deformation in the basement of Baltica and its relationship to the allochthonous units above.

In this project we will investigate rocks from the Middle and Lower Allochthon and underlying Precambrian basement. The samples are collected from the strategic vertical profiles at the surface and from two 2.5 km deep boreholes related to the Collisional Orogeny of the Scandinavian Caledonides (COSC) drilling project. The first borehole, COSC-1, was drilled in 2014 and the second, COSC-2, is planned for 2020. Multi-method thermochronology will be applied to the entire set of units and the methods include apatite fission-track, $^{40}Ar/^{39}Ar$ analyses on K-feldspar, white mica and ± amphibole and multi-diffusion domain (MDD) modeling on K-feldspar. Additionally, U-Pb zircon dating will be performed on the key samples. The complete pressure-temperature-time-deformation (P-T-t-D) paths will be constrained based on phase equilibria thermodynamic modeling coupled with modern thermobarometry methods, including trace elements and Raman-based geothermobarometers (P-T), low temperature thermochronology (T-t) and in-situ $^{40}Ar/^{39}Ar$ dating in relation to the microstructures (t-D).

The thermochronological data will serve the applicant and the scientific community as a reference for validating available models of exhumation of deeply subducted continental crust. The results will help explain how relatively intact allochthons can be transported hundreds of kilometers. The obtained data will be openly available for other future researchers and their studies concerning e.g. structural evolution of this orogenic belt, post-orogenic basins development, long-term continental denudation etc. In addition, it is important to note that the geological processes along active continental margins, followed by collisional tectonics and mountain building have a profound influence on human society. Massive mountain belts like the Himalayas influence climate and weather; natural disasters are common for settlements on its steep slopes and narrow valleys. Younger collisional systems are often associated with increased earthquake risk. This project together with the CALSUB (one of the NCN-funded projects) and COSC projects take a comprehensive approach to mountain building processes and their development through geological time by integrating the drilling project in the Caledonide orogen of Scandinavia with research in the Himalayas and other modern orogens.