Earth's mantle constitutes 84% of total volume of our planet. Ultramafic rocks forming the uppermost (lithospheric) mantle – peridotites – record variable processes and paths of evolution, depending, among others, on type of overlying crust. This geological "history" of mantle can be deciphered through detailed petrological and geochemical studies, giving insight on how different features observed today developed in time. Despite mantle being situated deeply underneath the continental (~ 35 km; subcontinental lithospheric mantle; SCLM) or oceanic crust (~7-10 km; suboceanic lithospheric mantle; SOLM), geological processes within crust occasionally sample mantle rocks. One of the most common process responsible for exhumation of such rocks is collision of continental plates – an orogeny.

The Scandinavian Caledonides represent ~400 million years old orogen. Two geological units of this orogenic belt – the Köli Nappe Complex (KNC) and the Seve Nappe Complex (SNC) – are abundant in small bodies (from meters to kilometres in length) of ultramafic rocks originating from the mantle. Their metamorphic features were already studied in detail by multiple authors, however igneous approach was applied only to several, focusing mostly on SNC and one specific type of peridotite (garnet peridotite). Ultramafic rocks of KNC were (nearly) not studied, while they may answer numerous questions regarding geological history of Scandinavian Caledonides. Contemporary models proposed for development of Scandinavian Caledonides vary. Rocks of KNC are believed to be fragments of lithosphere underlying ancient ocean (Iapetus) present between two paleocontinents; closure of the ocean led to collision between the continents. The Seve Nappe Complex is thought to represent thinned margin of one of the continental plates. The proposed origin is generally accepted for KNC, but continental origin of SNC remains not fully proven. Moreover, numerous scenarios of how and when fragments of mantle were emplaced within the nappes were suggested. Some of them point on significantly earlier stages, even before the creation of the ocean between two continental units (breakup of Rodinia paleosupercontinent), other ideas propose complex solutions where multiple smaller "plates" (microcontinental plates or volcanic arcs) collide before the final orogeny. These ideas are based on different (sometimes very scarce) evidences, which do not allow full acceptance of any of the solutions The controversy, which have been disputed for nearly 40 years of research on the subject, needs to be revisited and re-evaluated using contemporary knowledge on the lithospheric mantle and its evolution.

Aim of this project is to decipher geological history of ultramafic bodies within the nappes through a complex study of up to 50 occurrences. The study will merge classical and modern approach, connecting fieldwork and petrography with modern analytical instruments such as scanning electron microscopy, electron microprobe analysis (for major elements), mass spectrometry (for trace elements) or isotopic analysis to understand petrological and geochemical record of the rocks. This "lithospheric mantle perspective" will shed new light on how and through what kind of processes the Caledonian orogeny developed. Final results of this project will provide answers for the crucial questions concerning the Scandinavian Caledonides:

1) What affinity (SCLM vs SOLM) do ultramafic bodies emplaced within the Köli and Seve Nappe Complexes record?
2) What kind of process(es) and tectonic setting(s) they record?
3) Which of proposed genetic models is compatible with record from ultramafic rocks of the Köli and Seve Nappe Complexes?

These answers will create a complete image of characteristic and genesis of ultramafic rocks within both nappe complexes. With full understanding of origin of mantle domains involved in Caledonian orogeny and knowledge on development of the Scandinavian Caledonides, this study can provide an insight not only on one specific orogeny, but also serve as a universal example for other orogenic belts worldwide.