

Svalbard, the northwest sub-aerial exposure of the Barents Shelf, records a comprehensive geological record throughout much of geological time and thus provides invaluable insight into the geological history of the NW Barents Shelf and surrounding regions, a crucial element for geological investigations and paleo-plate reconstructions of the High Arctic.

A significant component of the geological record of Svalbard are two high pressure (HP) metamorphic localities in the Southwestern Caledonian Basement Province (SCBP) of Svalbard, exposed at Motalafjella in Oscar II Land and on Nordenskiöld Land (to the south of Oscar II Land), which represent vestiges of Caledonian subduction in Ordovician time. These HP localities are crucial to the understanding of subduction-exhumation dynamics of the Caledonian Orogeny (c. 470 – 400 Ma), and the tectonic evolution of the High Arctic during this time. Of particular importance for the subduction zone dynamics is the timing and rates of exhumation of these HP localities from within subduction zone. Regarding such issue, limited geochronological information has been published for Motalafjella, while no geochronological information has been gathered for Nordenskiöld Land. Another important issue which needs to be resolved is whether or not these two HP localities represent a single subduction zone. The current state of knowledge for peak metamorphic temperatures and pressures for HP lithologies at Motalafjella and Nordenskiöld Land, while taking into account the close spatial association of the two localities, suggests they represent a single subduction zone. However, without geochronological evidence constraining the subduction dynamics of the two HP localities, they cannot be correlated as a single subduction zone with confidence, which is a crucial for understanding the tectonic evolution of the Caledonian Orogeny.

Post-Caledonian tectonism may also be recorded within high-pressure shear zones associated with the Motalafjella and Nordenskiöld Land HP localities, important for understanding the tectonic evolution of the High Arctic in post-Caledonian orogenic time. These shear zones associated with the HP lithologies were most likely formed during exhumation of these HP localities to accommodate strain during exhumation. However, a significant amount of structural studies conducted in the SCBP indicate reactivation of Caledonian orogenic structures by later tectonic events, most notably during Eurekan tectonism (c. 53 – 34 Ma). In addition, first evidence of a shear-zone in Svalbard pertaining to the Ellesmerian Orogeny (c. 370 – 360 Ma) has been discovered (via Th-U-Pb monazite geochronology) on the island of Prins Karls Forland, located offshore to the west of Oscar II Land. This shear zone was later discovered to have been reactivated by Eurekan tectonism (via $^{40}\text{Ar}/^{39}\text{Ar}$ muscovite geochronology), providing first geochronological evidence of Eurekan reactivation in the SCBP. Taking into account the structural and limited geochronological studies, reactivation of the shear zones associated with the Motalafjella and/or Nordenskiöld Land HP localities by Ellesmerian or Eurekan tectonism is a significant possibility. Recognizing reactivation of these shear zones using geochronological methods is of significant importance as this information is critically lacking throughout the entirety of the SCBP which is of high importance for post-Caledonian High Arctic reconfigurations.

The project will comprise both fieldwork and laboratory work to achieve the project goals. Fieldwork will be conducted in a single field season, targeting both HP localities, and will be achieved through an international collaborative effort. Petrologic and macro-structural investigations, as well as sampling of both HP lithologies and associated shear zones, will be conducted during the fieldwork. Obtained samples will be thoroughly investigated using transmitted light microscopy and electron microprobe analyses for petrography, micro-structures and geochemistry. Select samples from both the HP lithologies and associated shear zones as both localities will be chosen for in-situ $^{40}\text{Ar}/^{39}\text{Ar}$ muscovite geochronology. These results will provide a significant contribution to the geochronological database of the SCBP as they will: 1) constrain the timing and rates of exhumation for the HP localities; 2) provide a means to test the hypothesis that these HP localities represent a single subduction zone; 3) investigate if post-Caledonian tectonism has affected these localities.

The results of this project will be instrumental for understanding the exhumation dynamics of Caledonian subduction zones represented by the HP metamorphic localities. Reactivation of the shear zones associated with HP lithologies would also provide novel information for post-Caledonian tectonism. Ultimately, these results will be important for High Arctic paleo-plate reconstructions during the Caledonian Orogeny, and/or post-Caledonian orogenic time.