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New blueschist facies province in the Caledonides of Svalbard

Karolina Kośmińska (1,2), Jarosław Majka (2), Iwona Klonowska (2), Michael Krumbholz (2), Maciej Manecki (1), and Jerzy Czerny (1)

(1) AGH – University of Science and Technology, Kraków, Poland (k.m.kosminska@gmail.com), (2) Uppsala University, Uppsala, Sweden

Here, we report the occurrence of previously unrecognized high-pressure metamorphic rocks in the Caledonian basement of Nordenskiöld Land and Wedel Jarlsberg Land (SW Svalbard). These rocks are represented by blueschists sensu stricto and blueschist facies metapelites. Blueschists are found in Nordeskiöld Land only. Typically, they occur in form of isolated bodies of different size enclosed in metasedimentary units. They consist mainly of reddish garnet and greenish and bluish amphiboles (including ferroglaucophane). Other major components are chlorite, epidote, biotite, quartz and albite. The garnets typically contain voluminous inclusions of epidote, albite, quartz, amphibole and titanite inclusions, and show a distinct chemical difference between cores and rims. Their composition varies from Alm49Pyr1Grs33Spss17 in the cores to Alm62Pyr0Grs36Spss2 in the rims. The change in chemical zoning is gradual, suggesting progressive garnet growth. P-T estimates based on thermodynamic modeling in the NCKFMMnASHT system indicate peak pressure conditions at c. 20kbar and 500°C.

Tectonically, the whole area is characterized by a moderate, 50°-dip of S0 and S1 (the main metamorphic foliation) to the north. Deviations from this direction are small and occur only locally, are mostly caused by the presence of rigid metamafic bodies, around which the common orientation of the bedding and the metamorphic foliation is disturbed. Moreover, shear sense indicators, such as commonly observed sigma clasts, clearly indicate a transport direction from north to south.

The structural observations are in good agreement with those collected south of the Nordenskiöld Land, in the northern part of Wedel Jarlsberg Land (Antoniabreen area), where high grade augen gneisses and metapelites tectonically emplaced onto typical low-grade rocks of SW Svalbard occur. The metapelites consist mainly of garnet, muscovite, biotite, chlorite and quartz. Two generations of garnet can be distinguished: garnet-I (Alm68Pyr8Grs9Spss9) forms inclusion-rich cores of composite grains; garnet-II (Alm49Pyr2Grs31Spss18) builds either euhedral rims on garnet-I cores or separate euhedral grains. Preliminary thermodynamic modeling in the NCKFMMnASHT system suggests the growth of garnet-I at c. 550°C and 6kbar, whereas garnet-II grew at c. 500°C and 12kbar. We suggest that the growth of garnet-I is connected to the Late Neoproterozoic Torellian event, while garnet-II has been growing under blueschist facies conditions, hence most probably during the Caledonian orogeny. Striking similarities in terms of tectonics and P-T conditions between the two studied areas suggest that vast parts of the Caledonian basement of Nordeskiöld Land and northern Wedel Jarlsberg Land were subjected to high-pressure metamorphism.

More regionally, these high pressure rocks may form an equivalent of the blueschists rocks known from Oskar II Land (Motalafjella region). Further detailed petrological and geochronological studies to verify this hypothesis are in progress.