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Re-investigating the Barrovian metamorphic rocks of the Isbjørnhamna Group, Svalbard Caledonides

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The Isbjørnhamna Group, which crops out in the south-west of Svalbard in the High Arctic, is crucial for understanding Svalbard's regional geology. It can be traced in southern Wedel Jarlsberg Land and Sørkapp Land, and it consists of a Barrovian-type series of metapelites that were metamorphosed during the Torellian (c. 640Ma; Majka et al. 2008) and overprinted during the Caledonian orogenesis (Majka & Kośmińska, 2017). Although relatively recent petrological study exists, there are certain gaps in it. In order to fill these gaps, we decided to re-investigate these rocks using the most up-to-date petrochronological approach. Hence, we aim to determine the metamorphic history of these rocks in detail, test the hypothesis if there are indeed several orogenic events registered by these rocks and what was a possible exhumation mechanism responsible for uplift of this sequence.

The studied garnet-bearing mica schists preserve four different parageneses, ranging from chloritoid to kyanite metamorphic zones. Here we report on the samples containing chlorite and chloritoid, kyanite, staurolite and both staurolite and kyanite. The studied samples are the same exact rocks that have been previously studied by Majka et al. (2008, 2010) using both geothermobarometry and petrogenetic grids in the KFMASH system. According to those authors the estimated pressure-temperature conditions (P-T) were c. 655°C at 11kbar for the kyanite-bearing shist, c. 624°C at 6.6 to 8.7kbar for the staurolite + kyanite pelite and c. 580°C at 8-9kbar for the staurolite-bearing rock. The chloritoid schist has not been studied previously.

Our preliminary phase equilibrium modelling in the MnNCKFMASHTO system using the Theriak-Domino software indicates P-T conditions of c. 660°C at 7 kbar for the kyanite-schist and c. 575°C at 8 to 9.5kbar for the staurolite-schist, respectively. The chloritoid schist yielded conditions of c. 560°C at 7.5kbar. Further P-T modelling coupled with in-situ Ar-Ar and U-Pb geochronology should allow for much better understanding of the complex geological history of these rocks as well as potential flaws in the previous studies.

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