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First evidence of the Ellesmerian metamorphism on Svalbard

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The Ellesmerian fold-and-thrust belt is exposed in the High Arctic from Ellesmere Island in the east, through North Greenland, to Svalbard in the west (e.g. Piepjohn et al., 2015). It developed during Late Devonian - Early Carboniferous, and overprinted older (mainly Caledonian) structures. It is thought that this fold-and-thrust belt was formed due to collision of the Pearya Terrane and Svalbard with the Franklinian Basin of Laurentia. Traditionally, the Ellesmerian fold-and-thrust belt comprises a passive continental margin affected by foreland deformation processes, but the exact larger scale tectonic context of this belt is disputable. It is partly because the Eocene Eurekan deformation superimposed significantly the Ellesmerian structures, thus making the reconstruction of the pre-Eurekan history very difficult.

Here we present for the first time evidence for Ellesmerian metamorphism within the crystalline basement of Svalbard. These rocks are exposed in the Pinkie unit on Prins Karls Forland (W-Svalbard), which exhibits tectonic contacts with the overlying sequences. The Pinkie unit is mainly composed of strongly deformed lithologies such as laminated quartzites, siliciclastic rocks and garnet-bearing mica schists. Detrital zircon dating yielded ages as young as Neoproterozoic (0.95-1.05 Ga), thus the Pinkie unit is considered to be Neoproterozoic (Kośmińska et al., 2015a). The M1 assemblages and D1 structures are affected by D2 mylonitization (cf. Faehnrich et al., 2016, this meeting).

Petrological characterization and Th-U-total Pb chemical monazite dating have been performed on the Pinkie metapelites. These rocks exhibit an apparent inverted Barrovian metamorphic sequence, within which three metamorphic zones have been distinguished: garnet+staurolite+muscovite+biotite, garnet+staurolite+kyanite+muscovite+biotite, garnet+kyanite+muscovite+biotite. The P-T estimates using the QuiG barometry coupled with thermodynamic modelling revealed that the metapelites were formed under amphibolite facies conditions at c. 7-9 kbar and 550-650 °C (Kośmińska et al., 2015b). Monazite dating was performed on samples from these three metamorphic zones. The chemical zonation of monazite allows the identification of several monazite populations, which likely developed during different stages of Barrovian metamorphism. The geochronology demonstrate protracted monazite growth from the early prograde stage at c. 370 Ma to the peak conditions at c. 355 Ma.

Thus it is evident that the Ellesmerian event was not limited to the relatively cold deformation as previously thought. The amphibolite facies metamorphism of c. 370-355 Ma that was documented in our study sheds new light on understanding of the character of this tectonothermal event.
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References:
Faehnrich et al., 2016. A tectonic window into the crystalline basement of Prins Karls Forland, Spitsbergen. EGU General Assembly 2016.
Kośmińska et al., 2015b. Metamorphic evolution of the Pinkie unit metapelites from Svalbard (High Arctic): P-T-t study including Quartz-in-garnet barometry (QuiG). GSA 2015: Annual Meeting, Baltimore.
Kośmińska et al., 2015a. Detrital zircon U-Pb geochronology of metasediments from southwestern Svalbard's Caledonian Province. EGU General Assembly 2015.
Piepjohn et al., 2015. Tectonic map of the Ellesmerian and Eurekan deformation belts on Svalbard, North Greenland, and the Queen Elizabeth Islands (Canadian Arctic). Arktos, DOI 10.1007/s41063-015-0015-7.