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A tectonic window into the crystalline basement of Prins Karls Forland, Svalbard

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Prins Karls Forland, Svalbard, comprises a fold-thrust belt as a result of the Eocene Eurekan orogeny. The northern part of the island (north of Selvågen) is dominated by Neoproterozoic siliciclastic metasediments regionally metamorphosed to greenschist facies conditions, probably in association with one distinct stage of Caledonian tectonism. Contrasting with these low grade sequences are rocks of the Pinkie Unit, which are locally exposed along east coast of Prins Karls Forland. Amphibolite facies metasediments show evidence for at least two distinct deformation stages (including mylonitization). All the borders of the Pinkie unit are tectonic: to the east, it is a sharp boundary with the truncation of the Pinkie foliation into a N-S fault, parallel to the coast, probably associated with the formation of the Neogene Forlandsundet Graben. A ∼1 km wide ductile to brittle shear zone (the Bouréefjellet shear zone) separates the low and high grade sequences along the western margin, with the Grampian Formation (low metamorphic grade quartzites, conglomerates, siltstones and slates) as the upper structural unit. Moreover, the shear zone contains outcrops of metagabbro associated with magnetite ore (Maraszewska et al. 2016, EGU). The apparent tectonostratigraphy of the Pinkie unit consists of laminated fine-grained calc-silicate rocks, locally with scapolite, and a strong E-W lineation at lower structural levels. In these rocks primary layering is apparent (S0) and parallel to metamorphic foliation plane (S1). Interconnected elongated mica crystals within S1 are deformed by C'-type shear zones. They are overlain by garnet-bearing quartzite-mylonites and garnet-bearing mylonitic mica schists with N-S to NW-SE lineations at upper structural levels. Kośmińska et al. (2015a, Mineralogia - Special Papers, vol. 44, 61-62) determined P-T metamorphic conditions of garnet–mica schist of 7-9 kbar and 550-650°C. The dominant population of metamorphic monazite present in garnet-bearing schist yields total-Pb dates of 370-355 Ma (Kośmińska et al. 2015b, Mineralogia - Special Papers, vol. 44, 60). Quartz recrystallization associated with mylonitisation is evident, showing subgrain rotation and bulging of grains, indicated by lobate grain boundaries. Garnets, plagioclases and amphiboles form porphyroclasts within foliation planes. Garnets forms pre- or syntectonic subhedral crystals, with S-trails quartz inclusions oblique to the foliation plane. Pretectonic porpyroclasts of feldspar are slightly fractured, but otherwise not ductilely deformed. Mica-fish structures and syntectonic snowball muscovite were also noted.
Thus, four stages of deformation can be distinguished in this region:
D1 associated with formation of metamorphic foliation S1;
D2 associated with mylonitization;
D3 associated with the shear zone;
D4 brittle deformations (faults, fractures and domino structures)
These new findings on shearing and sequence of deformation phases shed new light on tectonic evolution of Prins Karls Forland, and therefore enables better understanding of its complex history.
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