Early Devonian sinistral strike-slip in the Caledonian basement of Oscar II Land advocates for escape tectonics as a major mechanism for Svalbard terranes assembly

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The Svalbard's Southwestern Basement Province in contrary to the Northwestern and Eastern Basement Provinces is commonly correlated with the Pearya Terrane or Timanides and bears a complicated internal structure. Here, we present new data from Oscar II Land supporting the model of Svalbard's Basement being divided into the Laurentia and Barentsia plates in the late-Caledonian period.

In Oscar II Land the enigmatic Müllerneset Formation is tectonically juxtaposed against the remaining greenschist facies metamorphosed basement. It consists of Mesoproterozoic to Neoproterozoic metapelites and metapsammites that experienced a polymetamorphic history. The progressive amphibolite facies event M1 of unknown age reached the pressure-temperatures conditions of 5-7 kbar at 500-560 °C. The subsequent greenschist facies overprint (M2) is associated with mylonitization strongly pronounced across the whole Müllerneset Formation. Mylonitic foliation S2 dips steeply to the SW and it is associated with a stretching lineation dipping moderately-to-shallowly to the SE. In the western part of the unit, monazite is growing within the S2 foliation and related shear bands mainly replacing allanite. Th-U-total Pb dating of homogenous monazite population yielded a weighted average age of 410 ± 7 Ma with MSWD = 0.26 and p = 0.997. In the western part, where mylonitic foliation is less prevalent, monazite growths within M1 porphyroblasts and within the S2 foliation. Th-U-total Pb dating revealed an array of ages between 480 – 280 Ma with no correlation of chemical or structural features allowing divisions into subgroups.

Dating results indicating an early Caledonian signal should be attributed to the progressive M1 event. Uniform monazite age of 410 ± 7 Ma in the western part represents the timing of the M2 greenschist facies overprint. Younger ages obtained in the eastern part suggest fluid related disturbance of Th-U-Pb system during late Caledonian, Ellesmerian and Eurekan events. The timing of monazite growth during the M2 event is identical with the 410 ± 2 Ma ⁴₀Ar/³⁹Ar cooling age reported by Dallmeyer (1989). Geochronological evidence combined with structural
observations suggests that the Müllerneset Formation in the Early Devonian was tectonically exhumed on the NW-SE trending left-lateral strike-to oblique-slip shear zone. Similarly oriented tectonic zones within the Southwestern Basement Province, in the Berzeliuseggene unit and the Vimsodden-Kosibapasset Shear Zone are also of similar age. This set of anastomosing shear zones is roughly parallel to the proposed orientation of the suture between Barentsia and Laurentia (Gudlaugsson et al. 1998). The documented Early Devonian sinistral displacement may mark the western boundary of the Barentsia microplate laterally extruded during the final Caledonian collision in a style similar to present day Anatolian Plate escape.

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