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Eurekan deformation on Prins Karls Forland, Svalbard – new insights from Ar^{40}/Ar^{39} muscovite dating

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Eurekan deformation has been proven to be a complex sequence of tectonic episodes, dominated by compression in the Circum Arctic region. It was associated with early Cenozoic collision of Eurasia, North America and Greenland plates producing fold-thrust belt style of deformation. Timing of this enigmatic event has not yet been extensively resolved by radiometric dating (Piepjohn et al. 2016, Journal of the Geological Society, 173(6), 1007-1024). Reinhardt et al. (2013, Z. Dt. Ges. Geowiss., 164 (1), 131–147) dated syn-tectonic volcanic ashes at c. 60 Ma and 54 Ma on Ellesmere Island, Canada. Tagner et al. (2011, Earth and Planetary Science Letters, 303(3), 203-214) interpreted c. 49-47 Ma $^{40}Ar/^{39}Ar$ ages on trachyte flows in northern Greenland as peak compression during the Eurekan event. On Svalbard, Tessensohn et al. (2001, Geologisches Jahrbuch, B 91, 83-104) reported K/Ar whole rock ages ranging from c. 67 to 49 Ma for the slates from Svartfjella–Eidembukta–Daudmannsodden Lineament. Bentonite layers in the Central Tertiary Basin are as young as c. 56 Ma (Charles et al. 2011, Geochem. Geophys. Geosyst., 12, 1-19), predating latest deformation. Moreover, Barnes et al (2017, in prep.) applied (U-Th)/He thermochronology along the western margin of Svalbard and resolved Early to Middle Eocene heating, likely documenting burial related to thrusting. Here we present new results from $^{40}Ar/^{39}Ar$ muscovite dating of ductile to brittle shear zone on Prins Karls Forland, Svalbard, indicating Eurekan age of thrusting.

Prins Karls Forland is dominated by Neoproterozoic siliciclastic metasediments (comprising Caledonian basement) regionally metamorphosed to greenschist facies conditions. A $\sim$1 km wide ductile to brittle shear zone (the Bouréefjellet shear zone) separates the amphibolite facies Pinkie Unit from the lower grade upper structural unit, the Grampianfjella Formation (Faehnrich et al. 2016, EGU 2016). The age of the amphibolite facies metamorphism (c. 370-355 Ma) indicates Ellesmerian tectonism, unlike other higher grade rocks on Svalbard (Kośmińska et al. 2016, EGU 2016).

Ten metasedimentary rocks from within the shear zone were collected for dating, with eight muscovite crystals dated per sample via $^{40}Ar/^{39}Ar$ total fusion. High strain is evinced by mylonitic fabric, mica fish or C' shear zones. Moreover, quartz was dynamically recrystallized with significant grain boundary migration. There is notable age dispersion between the samples with weighted mean ages varying from 45 up to 103 Ma and single grain ages are more than 300 Ma, reflecting partial recrystallization and resetting during Eurekan deformation. Younger ages were obtained from lower structural levels, yielding dates of 44 to 54 Ma for the Eurekan deformation on Prins Karls Forland. We suggest that an Ellesmerian ductile shear zone was reactivated during Eocene (commencing as early as 54 Ma) progressing to brittle conditions which continued after 44 Ma. These are the first documented Eurekan $^{40}Ar/^{39}Ar$ muscovite deformation ages from Svalbard, and enable to better distinguish individual stages of the Eurekan deformation in the Eocene improving our understanding of relative plate tectonic movements.

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