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Ar/Ar age data of muscovite from the Keivy Terrane (central Kola Peninsula, arctic European Russia) imply a prolonged fluid-assisted recrystallisation

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Single grain muscovite $^{40}Ar/^{39}Ar$ age data from metasediments of the Keivy Terrane point to a prolonged recrystallisation, and imply that the younger age set in metamorphic terranes with a long history cannot always be simply interpreted as due to late and slow cooling. The Keivy terrane is an element of the Palaeoproterozoic Lapland-Kola collisional belt developed along the northern margin of the Fennoscandian (Baltic) Shield. It comprises a lower series of late Archaean meta-volcanic rocks, intruded by earliest Palaeoproterozoic alkali granites that are covered by strongly deformed quartz-rich kyanite-staurolite-garnet-micaschists of the Keivy unit that have yielded magmatic zircons as young as ∼2.35 Ga, which were derived from the substratum's alkaline granite.

$^{40}Ar/^{39}Ar$ step-heating dating with a defocussed laser beam of muscovite grains from seven metasediments of the Keivy unit yielded saddle-shaped age spectra in most experiments. In five out of seven cases the base of the saddle corresponded to a plateau age in the range of 1667 to 1593 Ma (60-90% of the gas release; 1 sigma errors: 1.0–1.2 Ma). We do not simply interpret these $^{40}Ar/^{39}Ar$ ages in the classical way as due to cooling, because the saddle shape of the spectra enables a more complete and detailed interpretation. Saddle-shaped age spectra may result from the presence of different argon reservoirs in partially recrystallised and chemically distinct micas that degas over a different energy interval: a primary, not recrystallised or inherited domain (low and high temperature steps) and a newly formed or recrystallised one (saddle minimum in the intermediate steps). The younger subdomains formed by growth or recrystallisation could characterise the last isotopic record during an extended (re)crystallisation history. It is striking that 1612 and 1615 Ma saddle minimum ages in two samples correspond to a plateau age of 1612 Ma in another sample. Also elevated high and/or low temperature apparent ages of about 1654 Ma in one sample agree to a plateau age of 1657 Ma in another sample. These data would point to recrystallisation lasting about 45 million years, or even around 75 million years, taking the difference between the oldest and youngest plateau ages. The age difference between elevated apparent ages of high and/or low temperature steps and the plateau in individual age spectra can amount to similar lengths of time. The occurrence of overgrowth rims with uniform high-U/low-Th ratios and 1.70–1.72 Ga ages around older zircons, previously revealed by NORDSIM ion probe dating of some of the samples we used, also points to low-temperature fluid alteration. The tectonic meaning of the 1.67–1.59 Ga muscovite ages is unclear, but the age range is comparable to the Gothian orogeny (1.75–1.55 Ga) and the voluminous anorthosite-rapakivi magmatism (1.67–1.45Ga) in the southern Baltic Shield. The latter event has been linked to the Gothian orogeny when a long-lived calc-alkaline Cordilleran-type continental margin arc was developed along the western margin of the Baltic Shield, but also to rifting around the Palaeoproterozoic–Mesoproterozoic boundary.