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New Ar/Ar single grain mineral ages from Korean orogenic belts with implications for the Triassic cooling and exhumation history

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The Korean peninsula is located in the eastern margin of the Eurasian continent where major late Palaeozoic to early Mesozoic continental collision zones, like the Central Asian Orogenic Belt and the Qinling-Dabie-Sulu Belt, merge with circum-Pacific subduction-accretion systems. Deciphering the tectonic evolution of Korea is thus crucial for the understanding of the amalgamation of East Asia. Classically, research in Korea has focused on the search for (ultra)high-pressure metamorphic rocks and their isotopic dating, most recently applying SHRIMP on Th- and U-bearing accessory minerals, in order to substantiate links with the Qinling-Dabie-Sulu Belt across the Yellow Sea in China. Instead of trying to date peak pressure conditions we focused on $^{40}Ar/^{39}Ar$ laser-probe step-heating dating of single grains of the fabric-forming minerals muscovite, biotite and amphibole, formed during retrograde recrystallisation and exhumation. This is a big advantage as their growth can be straightforwardly correlated to major phases of the tectono-metamorphic evolution of rocks. This approach helps to meet the major geochronological challenge of obtaining age estimates for the timing of specific tectono-metamorphic events in the Korean orogenic belts.

The Korean peninsula comprises a number of Palaeoproterozoic high-grade gneiss terranes; only one of which has been affected by Permo-Triassic metamorphism: the Gyeonggi Massif. We concentrated on the uppermost Gyeonggi Massif and the overlying Imjingang Belt, to the North, and the ill-defined Hongseong zone to the West, both constituted by younger metamorphic rocks. Both belts contain rare lenses of mafic rocks with relics of high-pressure metamorphism. Hornblende from a corona-textured amphibolite from the lowermost part of the Imjingang Belt yielded a U-shaped age spectrum, the base of which is formed by four concordant steps with a weighted mean age of 242.8 $\pm$ 2.4 Ma (15% ^{39}Ar release). Muscovites from strongly retrogressed and ductily deformed rocks in the mylonitised top of the Gyeonggi Massif yielded different 1σ plateau ages: 242.8 $\pm$ 1.0 Ma and 240.3 $\pm$ 1.0 Ma for two chlorite-mica schists, and 219.7 $\pm$ 0.9 Ma for a garnet-bearing micaceous quartzite. Two amphibolites from Neoproterozoic orthogneiss in the Hongseong area yielded concordant 1σ plateau ages of 228.1 $\pm$ 1.0 (biotite), 230.1 $\pm$ 1.0 (hornblende), and 229.8 $\pm$ 1.0 Ma (hornblende from a foliated garnet-bearing corona-textured amphibolite).

$^{40}Ar/^{39}Ar$ laser-probe dating produced robust evidence that cooling and exhumation of once deeply buried rocks in different parts of Korea essentially occurred in middle to late Triassic time. The concordance of hornblende and mica ages in each of the target areas implies a rapid cooling, during at least part of the history, which seems not to have been coeval. This corroborates the observation that our Ar/Ar mineral ages are only a couple of million years younger than CHIME and SHRIMP U-Pb ages in accessory minerals, which are in the 230-255 Ma range in the uppermost Gyeonggi Massif and Imjingang Belt, and between 225-235 Ma in the Hongseong area. However, the much younger muscovite age from the mylonitic quartzite implies a prolonged recrystallization in the ductile shear zone in the uppermost Gyeonggi Massif. This is subject of ongoing research.