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The occurrence of excess ^{40}Ar in amphibole: implication of $^{40}Ar/^{39}Ar$ dating by laser stepwise heating and *in vacuo* crushing

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Amphibole is one of the most common minerals dated by the $^{40}Ar/^{39}Ar$ method due to its relatively high retentivity for argon and widespread occurrence in metamorphic and igneous rocks [1]. In the Yuka terrane, north Qaidam orogen, NW China, amphibole widely occurs in high/ultrahigh pressure (HP/UHP) metamorphic rocks. There are still only rare $^{40}Ar/^{39}Ar$ age data available, which have been devoted to amphibole in this terrane thus far. Possible reasons for this include the fact that metamorphic amphibole is easily contaminated by excess ^{40}Ar.

Amphibole from a gneissic amphibolite from the Yuka eclogite–gneiss terrane, North Qaidam, has been analyzed by $^{40}Ar/^{39}Ar$ laser stepwise heating and *in vacuo* crushing methods. The release pattern of heating is somewhat saddle-shaped with a total gas age of 574.5 ± 2.5 Ma. This age is significantly older than the reported zircon U-Pb ages (c. 495 Ma) from the Yuka eclogite [2], indicating the presence of excess ^{40}Ar. The apparent K/Ca ratios are concordant with a mean value of 0.12 ± 0.02, which is consistent with EMP analysis results.

In order to decipher the occurrence of excess ^{40}Ar and constrain the age of amphibolite-facies retrogression, a duplicate amphibole sample was employed for $^{40}Ar/^{39}Ar$ analysis by *in vacuo* crushing. The crushing experiment exhibits a monotonically declining release spectrum with concordant apparent ages in the later crushing steps, which yields a plateau age of 460.9 ± 0.6 Ma. The data comprising the age plateaux form an excellent isochron with an intercept age of 457.6 ± 0.9 Ma. The crushing K/Ca spectrum shows a hump-shaped feature with a higher mean K/Ca ratio of 0.63 ± 0.05. The distinctly different K/Ca ratios for heating and crushing indicate that the gases released by these two methods are likely to have been derived from different sources.

References:

[1] McDougall and Harrison (1999), Oxford University Press, New York, 269pp

[2] Zhang JX (2005) Lithos 84(1–2): 51-76