$^{40}Ar/^{39}Ar$ crushing technique

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$^{40}Ar/^{39}Ar$ crushing has been devoloped for dating fluids associated with geological events, e.g., hydrothermal mineralization, metamorphism, gas and oil emplacement. More and more facts has proofed that the crushing technique is very useful to determine the time when the geological events occurred, especially for the cases in which other geochronological methods could not be applied.

The crusher is very important to obtain good results from the crushing experiments. We have already introduced the crusher improvement in detail [1-3]. Crushing frequancy is adjustable and usually set at 2 Hz. The pestle of ~230 g is lifted up at a hightness of 4 to 5 cm by a coil and then falling down freely to hit the mineral grains gently. The hitting times are increasing step by step with the experiment procedure. Now the crushing experiments can be done fully automatically through the Thermo© Qtegra Noble Gas Workflows and other professional softwares.

In order to verify the validness of the $^{40}Ar/^{39}Ar$ crushing technique, it is recently applied in dating the paragenetic trace potassium minerals, i.e., cassiterite, wolframite and quartz, from the tin-tungsten ores in southern China, in comparision to the $^{40}Ar/^{39}Ar$ ages of K-rich muscovite samples by laser stepwise heating. The results show that the isochron ages of trace potassium minerals in the final crushing steps, corresponding to the gas releases from primary fluid inclusions, are well concordant with the muscovite ages, indicating that $^{40}Ar/^{39}Ar$ crushing is very useful to determine mineralization ages from the primary fluid inclusions. The correlation plots of K-Cl-$^{40}Ar^{*}$ can also obtain the ages for the second and primary fluid inclusions. The $^{40}Ar/^{39}Ar$ crushing technique opens a new approach to date fluid activities. An interesting application is to date the natural gas accumulation in the Songliao Basin, NE China [4].

[1] Qiu *et al*. (2006) *GCA*, **70**: 2354-2370. [2] Qiu *et al*. (2007) *EPSL*, **256**: 224-232. [3] Qiu *et al*. (2008) *EPSL*, **268**: 501-514. [4] Qiu *et al*. (2011) *Geology* **39**: 451-454.