Microsample unspiked K-Ar dating: a new approach of argon geochronology

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By using laser fusion on microsamples (n×0.01 to n×0.1 mg), a new approach of unspiked K-Ar dating is proposed which can be readily performed using the facilities in a modern Ar geochronological laboratory. Well-calibrated K-Ar and $^{40}Ar/^{39}Ar$ standards (e.g., GA1550 in this study) are employed to directly quantify the contents of ^{40}Ar, ^{38}Ar and ^{36}Ar, from which a K-Ar age is calculated. Repeated dating using laser fusion suppresses inaccuracies arising from the possible inhomogeneity of K and increases the precision of K-Ar ages. Isochrons are readily obtained using this new technique to cover the shortcomings of K-Ar dating. We design a new "inverse isochron" for K-Ar dating that has the same merits as that of $^{40}Ar/^{39}Ar$ method over normal isochron. Analyzing international standard FCs, B4M and MMhb-1 as unknowns shows that this approach is able to yield accurate and precise age results and to assess the trapped Ar compositions. Due to its use of inverse isochrons, this approach can partly replace $^{40}Ar/^{39}Ar$ for dating alteration-free rocks or minerals with a closed Ar system throughout a broad geological time interval. The new approach will provide an alternate method of Ar geochronology for low-cost, easy-to-operate, quick and accurate dating.

Keywords: a new approach, microsample unspiked K-Ar dating, a new inverse isochron